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### Notations

As presented in [Petit et al., 2001] for the Z12-T, the calibration of a geodetic system is divided in (up to) 6 different parts (Figure 1)

- $X_P$  = Delay of the 1PPS-in with respect to the laboratory reference
- $X_O$  = Delay of the “internal reference” with respect to the 1PPS-in

$(X_P + X_O) = \text{REFDLY.}$

- $X_C$  = antenna cable delay

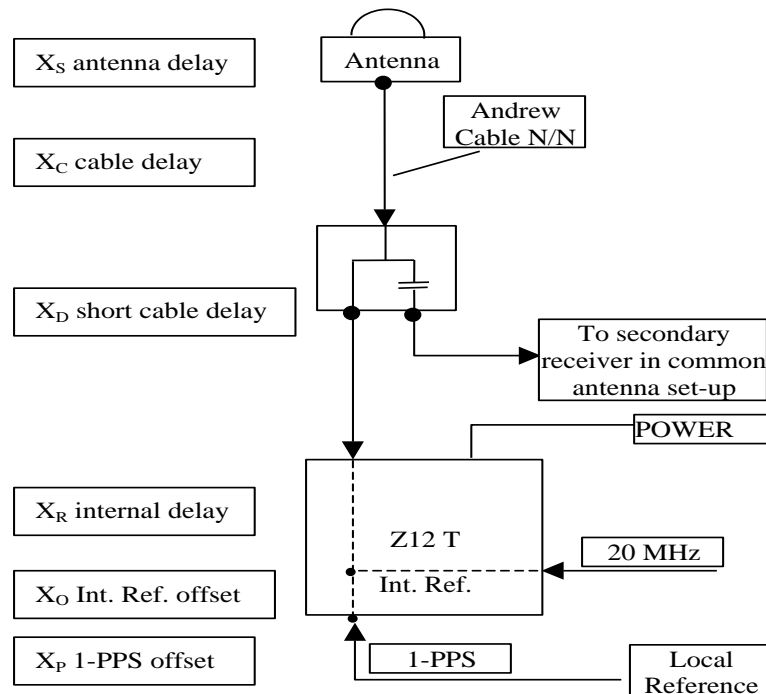
- [ $X_D$  = short cable + splitter delay]

$(X_C + X_D) = \text{CABDLY.}$  In practice,  $X_D$  is generally not used.

- $X_R$  = receiver internal delay, measured from the “internal reference”

- $X_S$  = antenna delay

$(X_R + X_S) = \text{INTDLY.}$



**Figure 1:** Definition of the different delays used in the most general set-up of a geodetic system (here shown for a Z12-T) from [Petit et al, 2001].

**4/ phase 4**

Laboratories: BIPM, NIST, USNO

**4.1/ BIPM (14344)**Period

MJD 57001 to 57006

Delays

All measurements at BIPM carried out by L. Tisserand.

Equipment used to measure internal delay of local receiver is a time interval counter (TIC), model SR620, maker Stanford Research Systems, s/n: 4680, with measurement uncertainty typically less than 0.5 ns (using external reference frequency as timebase).

Equipment used to measure internal delay of traveling receivers is a time interval counter (TIC), model SR620, maker Stanford Research Systems, s/n: 5482, with measurement uncertainty typically less than 0.5 ns (using external reference frequency as timebase).

## BP0R:

$$\begin{aligned}
 X_O &= 227.6 \text{ ns} && (267.6-48.7+8.7) \\
 X_P &= 42.7 \text{ ns} && (BP1R+C139+BP1S+C72) \\
 \text{REFDLY} &= 270.3 \text{ ns} \\
 \text{CABDLY} = X_C &= 133.4 \text{ ns} && (C113)
 \end{aligned}$$

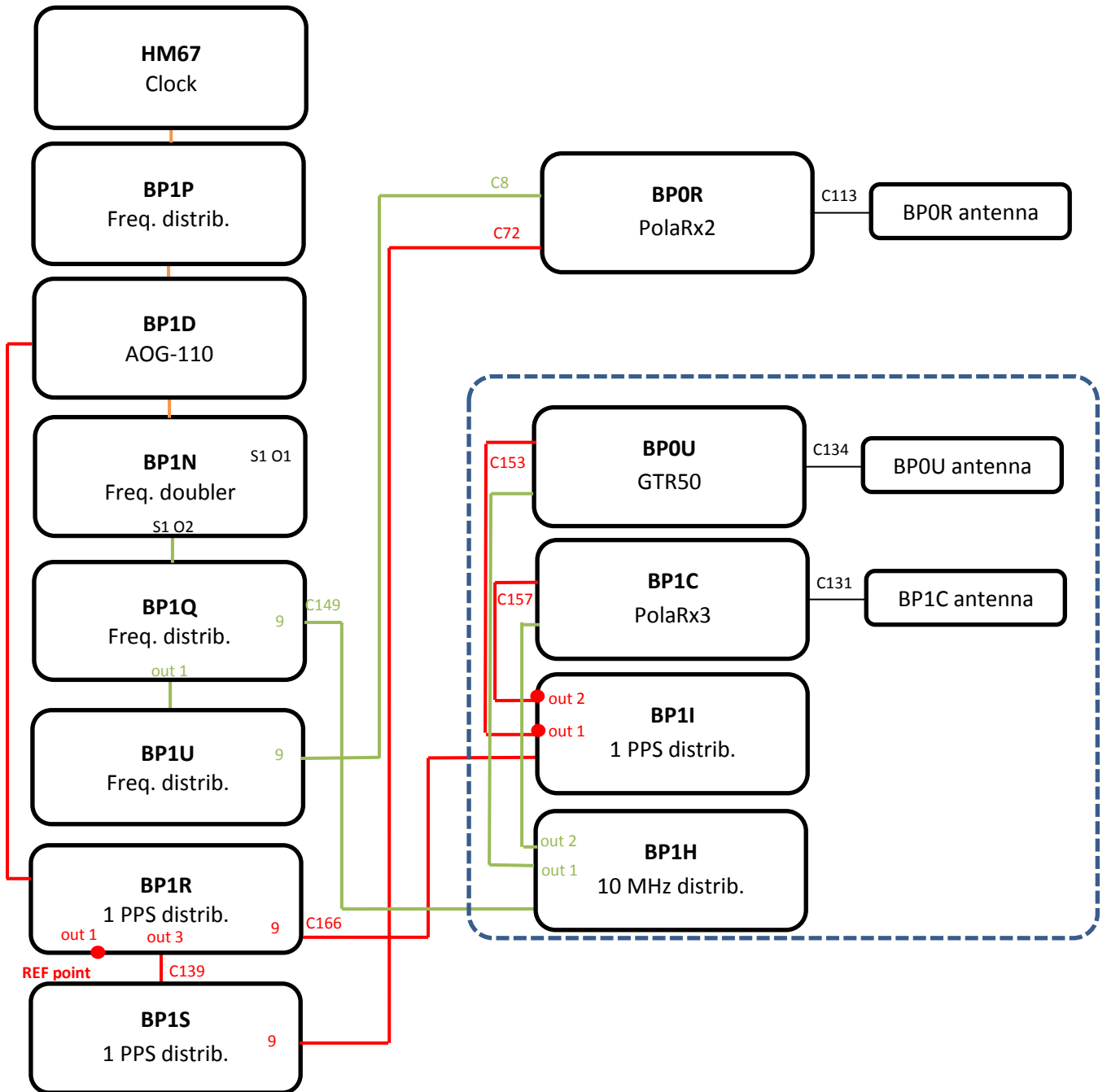
## BP0U:

$$\begin{aligned}
 \text{REFDLY} = X_P &= 52.6 \text{ ns} && (BP1R+C166+BP1I+C153) \\
 \text{CABDLY} = X_C &= 182.0 \text{ ns} && (C134)
 \end{aligned}$$

## BP1C:

$$\begin{aligned}
 X_O &= 205.3 \text{ ns} && (220.6-15.3) \\
 X_P &= 52.6 \text{ ns} && (BP1R+C166+BP1I+C157) \\
 \text{REFDLY} &= 257.9 \text{ ns} \\
 \text{CABDLY} = X_C &= 235.7 \text{ ns} && (C131)
 \end{aligned}$$

Setup at the BIPM



BP0U-BP0R

## COMPUTATION OF BASELINE

Number of codes to fit baseline and biases = 61580  
 Computed code bias (P1/P2)/m = -27.785 -26.741  
 Computed baseline (X,Y,Z)/m = -5.296 -0.794 4.290  
 RMS of residuals /m = 0.701

Number of phase differences to fit baseline = 55580  
 A priori baseline (X,Y,Z)/m = -5.296 -0.794 4.290  
 13381 clock jitters computed out of 13573 intervals  
 AVE jitter /ps = -0.3 RMS jitter /ps = 38.4

Iter 1 Large residuals L1= 0  
 Iter 1 Large residuals L2= 0  
 Computed baseline L1 (X,Y,Z)/m = 0.099 0.031 0.179  
 RMS of residuals L1 /m = 0.004  
 Computed baseline L2 (X,Y,Z)/m = 0.120 0.033 0.192  
 RMS of residuals L2 /m = 0.004

Final baseline L1 (X,Y,Z)/m = -5.197 -0.764 4.469  
 Final baseline L2 (X,Y,Z)/m = -5.175 -0.761 4.481

## COMPUTATION OF CODE DIFFERENCES

Number of code differences = 61695

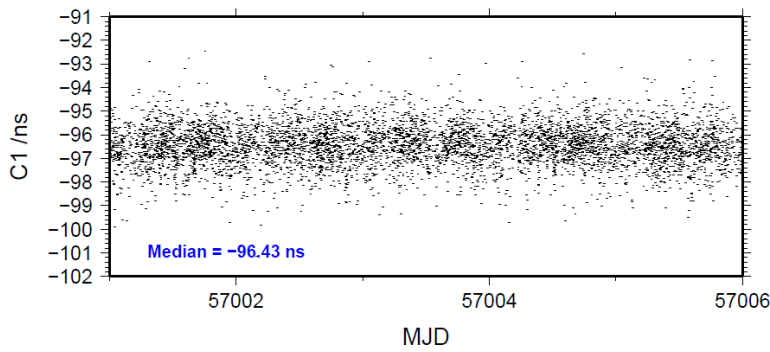
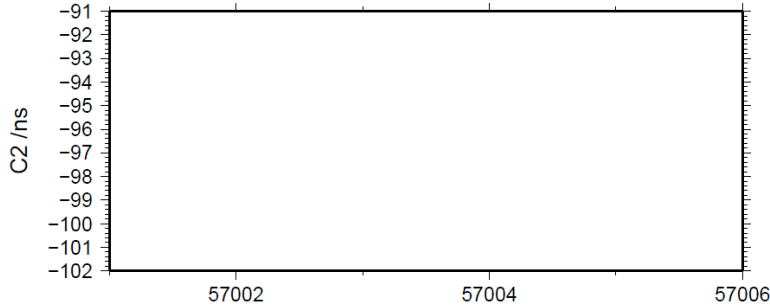
Global average of individual differences

Code #pts, ave/ns, rms/ns  
 C1: 61665 -96.439 1.493  
 C2: 0-NaN -NaN  
 P1: 61555 -93.197 2.381  
 P2: 61549 -89.780 2.748

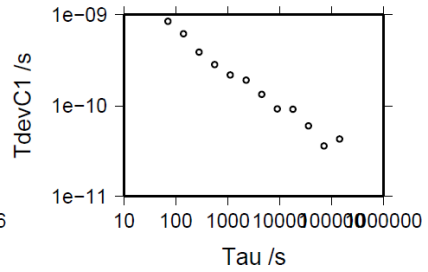
Number of 300s epochs in out file = 1438

Code #pts, median/ns, ave/ns, rms/ns  
 C1: 6169 -96.428 -96.430 0.854  
 C2: 0 0.000-NaN -NaN  
 P1: 6165 -93.229 -93.225 1.224  
 P2: 6165 -89.692 -89.737 1.567

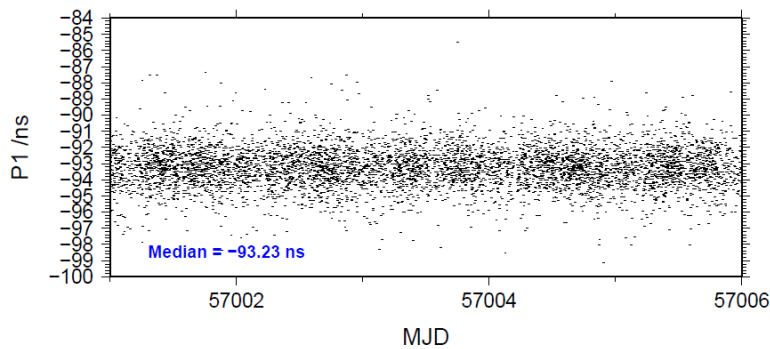
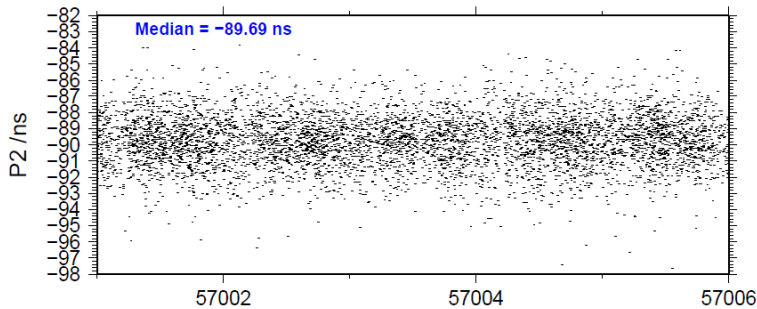
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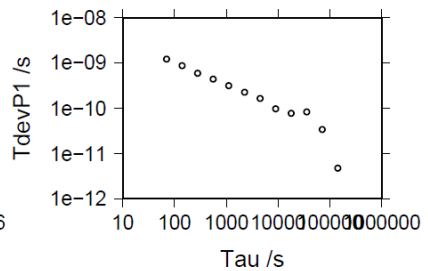
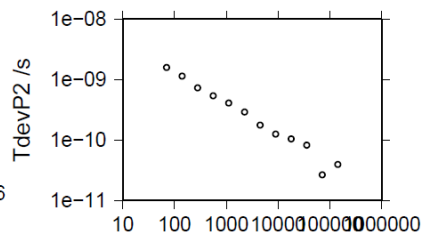
- 143340 s: C1= 43 ps
- 71670 s: C1= 36 ps
- 35835 s: C1= 60 ps
- 17918 s: C1= 91 ps
- 8959 s: C1= 92 ps
- 4479 s: C1= 133 ps
- 2240 s: C1= 190 ps
- 1120 s: C1= 217 ps
- 560 s: C1= 283 ps
- 280 s: C1= 387 ps
- 140 s: C1= 615 ps
- 70 s: C1= 849 ps



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- 143433 s: P1= 5 ps      143433 s: P2= 40 ps
- 71717 s: P1= 34 ps    71717 s: P2= 26 ps
- 35858 s: P1= 83 ps    35858 s: P2= 82 ps
- 17929 s: P1= 78 ps    17929 s: P2= 104 ps
- 8965 s: P1= 97 ps     8965 s: P2= 125 ps
- 4482 s: P1= 166 ps    4482 s: P2= 177 ps
- 2241 s: P1= 226 ps    2241 s: P2= 291 ps
- 1121 s: P1= 317 ps    1121 s: P2= 409 ps
- 560 s: P1= 437 ps     560 s: P2= 539 ps
- 280 s: P1= 589 ps     280 s: P2= 730 ps
- 140 s: P1= 878 ps     140 s: P2= 1139 ps
- 70 s: P1= 1214 ps     70 s: P2= 1576 ps



BP1C-BP0R

## COMPUTATION OF BASELINE

Number of codes to fit baseline and biases = 80063  
 Computed code bias (P1/P2)/m = -17.682 -16.617  
 Computed baseline (X,Y,Z)/m = -4.451 -0.748 3.692  
 RMS of residuals /m = 0.667

Number of phase differences to fit baseline = 78622  
 A priori baseline (X,Y,Z)/m = -4.451 -0.748 3.692  
 13896 clock jitters computed out of 13896 intervals  
 AVE jitter /ps = 0.3 RMS jitter /ps = 5.7

Iter 1 Large residuals L1= 0  
 Iter 1 Large residuals L2= 1  
 Computed baseline L1 (X,Y,Z)/m = 0.002 0.034 0.120  
 RMS of residuals L1 /m = 0.004  
 Computed baseline L2 (X,Y,Z)/m = 0.005 0.046 0.125  
 RMS of residuals L2 /m = 0.005

Iter 2 Large residuals L1= 0  
 Iter 2 Large residuals L2= 1  
 Computed baseline L1 (X,Y,Z)/m = 0.002 0.034 0.120  
 RMS of residuals L1 /m = 0.004  
 Computed baseline L2 (X,Y,Z)/m = 0.005 0.046 0.125  
 RMS of residuals L2 /m = 0.005

Final baseline L1 (X,Y,Z)/m = -4.449 -0.714 3.812  
 Final baseline L2 (X,Y,Z)/m = -4.446 -0.702 3.817

## COMPUTATION OF CODE DIFFERENCES

Number of code differences = 82041

Global average of individual differences

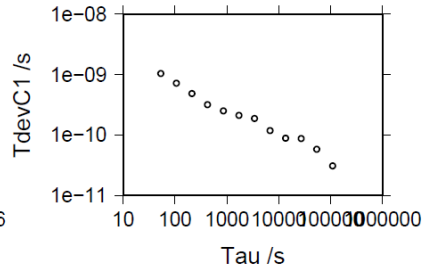
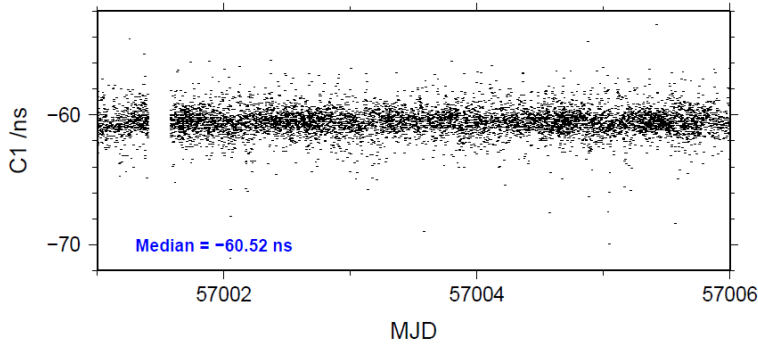
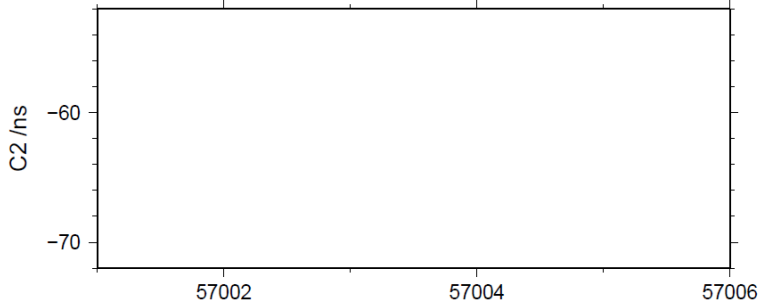
Code #pts, ave/ns, rms/ns  
 C1: 81673 -60.517 1.948  
 C2: 0-NaN -NaN  
 P1: 80019 -59.187 2.478  
 P2: 79946 -55.665 2.848

Number of 300s epochs in out file = 1392

Code #pts, median/ns, ave/ns, rms/ns  
 C1: 8114 -60.520 -60.516 1.027  
 C2: 0 0.000-NaN -NaN  
 P1: 7978 -59.256 -59.205 1.322  
 P2: 7969 -55.703 -55.672 1.587

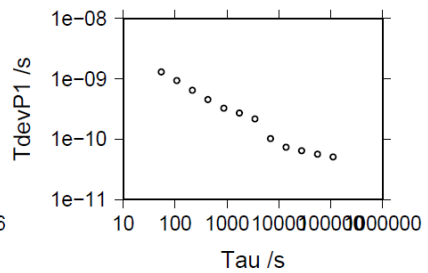
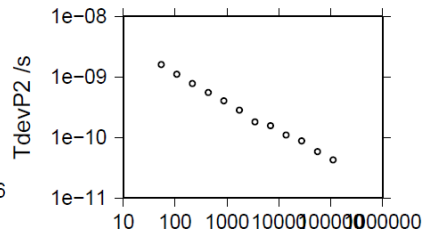
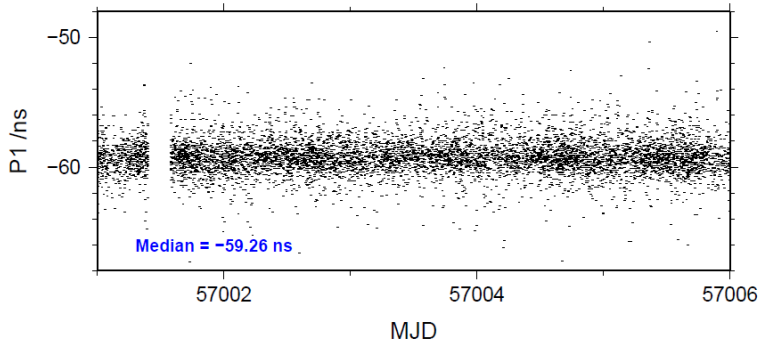
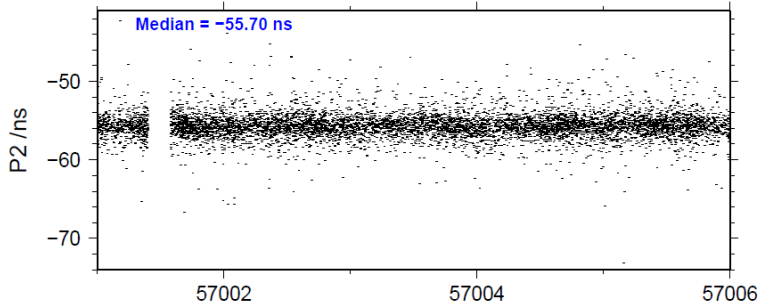
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- 108976 s: C1= 31 ps
- 54488 s: C1= 58 ps
- 27244 s: C1= 87 ps
- 13622 s: C1= 88 ps
- 6811 s: C1= 118 ps
- 3406 s: C1= 189 ps
- 1703 s: C1= 212 ps
- 851 s: C1= 250 ps
- 426 s: C1= 319 ps
- 213 s: C1= 482 ps
- 106 s: C1= 718 ps
- 53 s: C1= 1045 ps



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- 110834 s: P1= 51 ps
- 55417 s: P1= 57 ps
- 27708 s: P1= 65 ps
- 13854 s: P1= 74 ps
- 6927 s: P1= 103 ps
- 3464 s: P1= 216 ps
- 1732 s: P1= 271 ps
- 866 s: P1= 329 ps
- 433 s: P1= 456 ps
- 216 s: P1= 652 ps
- 108 s: P1= 942 ps
- 54 s: P1= 1303 ps
- 110959 s: P2= 42 ps
- 55480 s: P2= 58 ps
- 27740 s: P2= 88 ps
- 13870 s: P2= 110 ps
- 6935 s: P2= 157 ps
- 3467 s: P2= 180 ps
- 1734 s: P2= 283 ps
- 867 s: P2= 401 ps
- 433 s: P2= 550 ps
- 217 s: P2= 780 ps
- 108 s: P2= 1116 ps
- 54 s: P2= 1603 ps





## 4.2/ NIST (15024)

### Period

MJD 57046 to 57055

### Delays

#### BP0U:

REFDLY =  $X_P$  = 743.44 ns (690.84+C166+BP1I+C153=690.84+52.6)  
CABDLY =  $X_C$  = 182.0 ns (C134)

#### BP1C:

$X_O$  = 195.7 ns (210.7-15.0)  
 $X_P$  = 743.44 ns (690.84+C166+BP1I+C153=690.84+52.6)  
REFDLY = 939.14 ns  
CABDLY =  $X_C$  = 235.7 ns (C131)

#### NIST:

$X_O$  = 13.3 ns  
 $X_P$  = 66.69 ns  
REFDLY = 79.99 ns  
CABDLY = 275.5 ns

#### NIS3 (NB01):

$X_O$  = 5.12 ns  
 $X_P$  = 1540.66 ns  
REFDLY = 1545.78 ns  
CABDLY = 298.5 ns

#### NIS4 (NB02):

$X_O$  = 15.14 ns  
 $X_P$  = 1501.35 ns  
REFDLY = 1516.49 ns  
CABDLY = 298.0 ns



**Annex A - Information Sheet**

(to be repeated for each calibrated system)

| Laboratory:   | NIST                 |               |
|---|----------------------|---------------|
| Date and hour of the beginning of measurements:   | 01/24/2015 00.00 UTC |               |
| Date and hour of the end of measurements:   | 02/01/2015 24.00 UTC |               |
| Information on the system   |                      |               |
|   | Local:               | Travelling:   |
| 4-character BIPM code   | NB01                 | BPIC, BP0U    |
| • Receiver maker and type:  | Novatel OEM5         |               |
| Receiver serial number:   | NAP10500009          |               |
| 1 PPS trigger level /V:   | 0.5                  |               |
| • Antenna cable maker and type:   | Andrew LDF2-50       |               |
| Phase stabilised cable (Y/N):   | N                    |               |
| Length outside the building /m:   | 5.0                  |               |
| • Antenna maker and type:   | Novatel 703          |               |
| Antenna serial number:  | NEG10500001          |               |
| Temperature (if stabilised) /°C   |                      |               |
| Measured delays /ns   |                      |               |
| (if needed fill box "Additional Information" below)   |                      |               |
|   | Local:               | Travelling:   |
| • Delay from local UTC to receiver 1 PPS-in:  | 1540.66 ± 0.12       | 690.84 ± 0.08 |
| Delay from 1 PPS-in to internal Reference (if different):<br><small>(see section 2 for details)</small> | 5.12 ± 0.06          |               |
| • Antenna cable delay:  | 298.5 ± 0.25         | (1)           |
| Splitter delay (if any):  | N/A                  | (1)           |
| Additional cable delay (if any):  | N/A                  | (1)           |
| Data used for the generation of CGGTTS files  |                      |               |
| • INT DLY (GPS) /ns:  |                      |               |
| • INT DLY (GLONASS) /ns:  |                      |               |
| • CAB DLY /ns:  | 298.5 ± 0.25         |               |
| • REF DLY /ns:  | 1545.77 ± 0.1        |               |
| • Coordinates reference frame:  | WGS84                |               |
| X /m:   | -1288547.087         |               |
| Y /m:   | -4721701.103         |               |
| Z /m:   | 4078586.498          |               |
| General information   |                      |               |
| • Rise time of the local UTC pulse:   | 3 ns                 |               |
| • Is the laboratory air conditioned:  | yes                  |               |
| Set temperature value and uncertainty:  | 21.2 ± 0.5 °C        |               |
| Set humidity value and uncertainty:   |                      |               |

(1) For a trip with closure, not needed is the traveling equipment is used in the same set-up throughout

**Annex A - Information Sheet**

(to be repeated for each calibrated system)

| Laboratory:  | NIST                 |               |
|--|----------------------|---------------|
| Date and hour of the beginning of measurements:  | 01/24/2015 00.00 UTC |               |
| Date and hour of the end of measurements:  | 02/01/2015 24.00 UTC |               |
| Information on the system  |                      |               |
|  | Local:               | Travelling:   |
| 4-character BIPM code  | NB02                 | BPIC, BP0U    |
| • Receiver maker and type:   | Novatel OEM5         |               |
| Receiver serial number:  | NAP10500008          |               |
| 1 PPS trigger level /V:  | 0.5                  |               |
| • Antenna cable maker and type:  | Andrew LDF2-50       |               |
| Phase stabilised cable (Y/N):  | N                    |               |
| Length outside the building /m:  | 7.5                  |               |
| • Antenna maker and type:  | Novatel 703          |               |
| Antenna serial number:   | NEG10390004          |               |
| Temperature (if stabilised) /°C  |                      |               |
| Measured delays /ns  |                      |               |
| (if needed fill box "Additional Information" below)                                      |                      |               |
|  | Local:               | Travelling:   |
| • Delay from local UTC to receiver 1 PPS-in:   | 1501.35 ± 0.08       | 690.84 ± 0.08 |
| Delay from 1 PPS-in to internal Reference (if different):<br>(see section 2 for details) | 15.14 ± 0.07         |               |
| • Antenna cable delay:   | 298.0 ± 0.3          | (1)           |
| Splitter delay (if any):   | N/A                  | (1)           |
| Additional cable delay (if any):   | N/A                  | (1)           |
| Data used for the generation of CGGTTS files   |                      |               |
| • INT DLY (GPS) /ns:   |                      |               |
| • INT DLY (GLONASS) /ns:   |                      |               |
| • CAB DLY /ns:   | 298.0 ± 0.3          |               |
| • REF DLY /ns:   | 1516.49 ± 0.11       |               |
| • Coordinates reference frame:   | WGS84                |               |
| X /m:  | -1288550.036         |               |
| Y /m:  | -4721698.460         |               |
| Z /m:  | 4078588.617          |               |
| General information  |                      |               |
| • Rise time of the local UTC pulse:  | 3 ns                 |               |
| • Is the laboratory air conditioned:   | yes                  |               |
| Set temperature value and uncertainty:   | 21.2 ± 0.5 °C        |               |
| Set humidity value and uncertainty:  |                      |               |

(1) For a trip with closure, not needed is the traveling equipment is used in the same set-up throughout.

**Annex A - Information Sheet**

(to be repeated for each calibrated system)

| Laboratory:  | NIST                 |               |
|--|----------------------|---------------|
| Date and hour of the beginning of measurements:  | 01/24/2015 00.00 UTC |               |
| Date and hour of the end of measurements:  | 02/01/2015 24.00 UTC |               |
| Information on the system  |                      |               |
|  | Local:               | Travelling:   |
| 4-character BIPM code  | NIST                 | BPIC, BP0U    |
| • Receiver maker and type:   | Novatel OEM4-G2      |               |
| Receiver serial number:  | NVH04230007          |               |
| 1 PPS trigger level /V:  | 1.0                  |               |
| • Antenna cable maker and type:  | Andrew FSJ1-50A      |               |
| Phase stabilised cable (Y/N):  | N                    |               |
| Length outside the building /m:  | 65.0                 |               |
| • Antenna maker and type:  | Novatel 702          |               |
| Antenna serial number:   |                      |               |
| Temperature (if stabilised) /°C  |                      |               |
| Measured delays /ns  |                      |               |
| (if needed fill box "Additional Information" below)                                      |                      |               |
|  | Local:               | Travelling:   |
| • Delay from local UTC to receiver 1 PPS-in:   | 66.69 ± 0.02         | 690.84 ± 0.08 |
| Delay from 1 PPS-in to internal Reference (if different):<br>(see section 2 for details) | 13.3 ± 0.1           |               |
| • Antenna cable delay:   | 275.5                | (1)           |
| Splitter delay (if any):   | N/A                  | (1)           |
| Additional cable delay (if any):   | N/A                  | (1)           |
| Data used for the generation of CCGTTS files<br>(VALUES USED PRIOR TO THIS CALIBRATION)  |                      |               |
| • INT DLY (GPS) /ns:   | -44.7                |               |
| • INT DLY (GLONASS) /ns:   |                      |               |
| • CAB DLY /ns:   | 275.5                |               |
| • REF DLY /ns:   | 114.5                |               |
| • Coordinates reference frame:   | WGS84                |               |
| X /m:  | -1288398.360         |               |
| Y /m:  | -4721697.040         |               |
| Z /m:  | 4078625.500          |               |
| General information  |                      |               |
| • Rise time of the local UTC pulse:  | 3 ns                 |               |
| • Is the laboratory air conditioned:   | yes                  |               |
| Set temperature value and uncertainty:   | 25.2 ± 0.7 °C        |               |
| Set humidity value and uncertainty:  |                      |               |

(1) For a trip with closure, not needed is the traveling equipment is used in the same set-up throughout

BPOU-NIST

## COMPUTATION OF BASELINE

Number of codes to fit baseline and biases = 81649  
 Computed code bias (P1/P2)/m = -246.261 -244.688  
 Computed baseline (X,Y,Z)/m = -64.475 -35.937 -59.123  
 RMS of residuals /m = 0.577

Number of phase differences to fit baseline = 89407  
 A priori baseline (X,Y,Z)/m = -64.475 -35.937 -59.123  
 17207 clock jitters computed out of 17221 intervals  
 AVE jitter /ps = 0.0 RMS jitter /ps = 29.0

Iter 1 Large residuals L1= 7  
 Iter 1 Large residuals L2= 7  
 Computed baseline L1 (X,Y,Z)/m = 0.028 -0.106 0.088  
 RMS of residuals L1 /m = 0.003  
 Computed baseline L2 (X,Y,Z)/m = 0.038 -0.084 0.060  
 RMS of residuals L2 /m = 0.003

Iter 2 Large residuals L1= 7  
 Iter 2 Large residuals L2= 7  
 Computed baseline L1 (X,Y,Z)/m = 0.028 -0.106 0.088  
 RMS of residuals L1 /m = 0.003  
 Computed baseline L2 (X,Y,Z)/m = 0.038 -0.084 0.060  
 RMS of residuals L2 /m = 0.003

Final baseline L1 (X,Y,Z)/m = -64.447 -36.043 -59.035  
 Final baseline L2 (X,Y,Z)/m = -64.437 -36.021 -59.063

## COMPUTATION OF CODE DIFFERENCES

Number of code differences = 94929

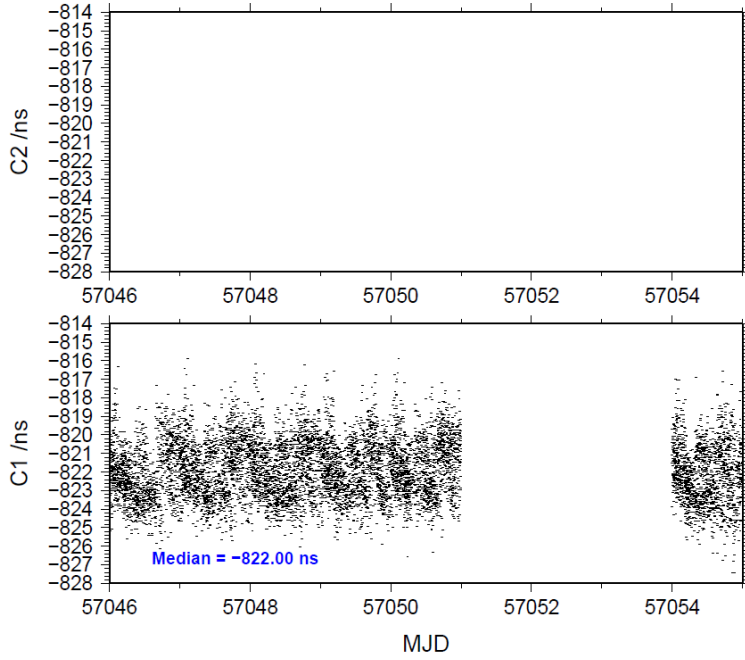
Global average of individual differences

Code #pts, ave/ns, rms/ns  
 C1: 94882 -821.910 1.897  
 C2: 0-NaN -NaN  
 P1: 94850 -821.725 1.888  
 P2: 94849 -816.358 2.184

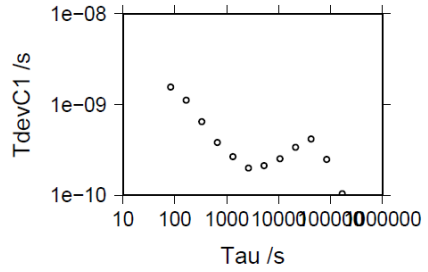
Number of 300s epochs in out file = 1728

Code #pts, median/ns, ave/ns, rms/ns  
 C1: 9417 -822.002 -821.905 1.560  
 C2: 0 0.000-NaN -NaN  
 P1: 9416 -821.778 -821.745 1.223  
 P2: 9416 -816.317 -816.343 1.506

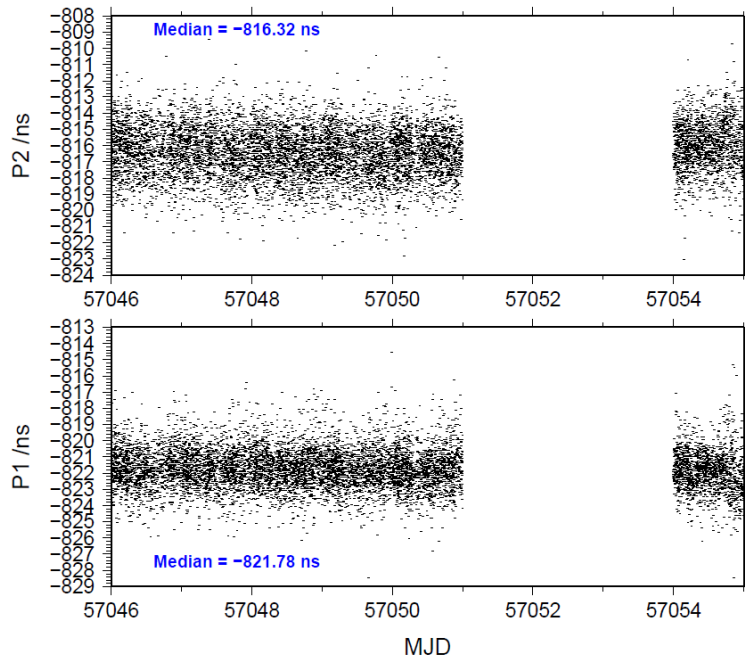
03/18/15 bp0unist15024\_9



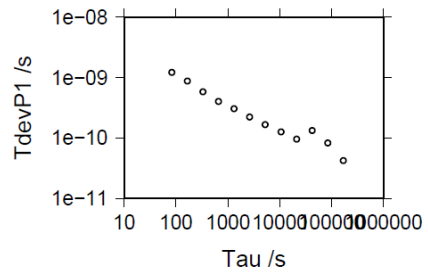
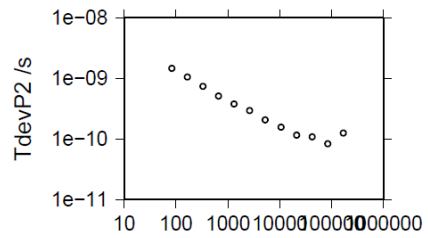
- 169064 s: C1= 104 ps
- 84532 s: C1= 249 ps
- 42266 s: C1= 419 ps
- 21133 s: C1= 339 ps
- 10567 s: C1= 253 ps
- 5283 s: C1= 213 ps
- 2642 s: C1= 201 ps
- 1321 s: C1= 267 ps
- 660 s: C1= 382 ps
- 330 s: C1= 646 ps
- 165 s: C1= 1114 ps
- 83 s: C1= 1553 ps



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- 169082 s: P1= 42 ps      169082 s: P2= 125 ps
- 84541 s: P1= 83 ps      84541 s: P2= 83 ps
- 42271 s: P1= 134 ps     42271 s: P2= 108 ps
- 21135 s: P1= 96 ps      21135 s: P2= 115 ps
- 10568 s: P1= 127 ps     10568 s: P2= 156 ps
- 5284 s: P1= 167 ps      5284 s: P2= 207 ps
- 2642 s: P1= 223 ps      2642 s: P2= 295 ps
- 1321 s: P1= 304 ps      1321 s: P2= 375 ps
- 660 s: P1= 403 ps      660 s: P2= 512 ps
- 330 s: P1= 583 ps      330 s: P2= 740 ps
- 165 s: P1= 877 ps      165 s: P2= 1057 ps
- 83 s: P1= 1216 ps      83 s: P2= 1465 ps



BP0U-NIS3

## COMPUTATION OF BASELINE

Number of codes to fit baseline and biases = 115056  
 Computed code bias (P1/P2)/m = 167.091 172.335  
 Computed baseline (X,Y,Z)/m = -213.115 -40.078 -97.983  
 RMS of residuals /m = 0.660

Number of phase differences to fit baseline = 132051  
 A priori baseline (X,Y,Z)/m = -213.115 -40.078 -97.983  
 25123 clock jitters computed out of 25200 intervals  
 AVE jitter /ps = -0.4 RMS jitter /ps = 29.3

Iter 1 Large residuals L1= 3  
 Iter 1 Large residuals L2= 3  
 Computed baseline L1 (X,Y,Z)/m = 0.119 0.113 -0.003  
 RMS of residuals L1 /m = 0.003  
 Computed baseline L2 (X,Y,Z)/m = 0.123 0.141 -0.031  
 RMS of residuals L2 /m = 0.003

Iter 2 Large residuals L1= 3  
 Iter 2 Large residuals L2= 3  
 Computed baseline L1 (X,Y,Z)/m = 0.119 0.113 -0.003  
 RMS of residuals L1 /m = 0.003  
 Computed baseline L2 (X,Y,Z)/m = 0.123 0.141 -0.031  
 RMS of residuals L2 /m = 0.003

Final baseline L1 (X,Y,Z)/m = -212.996 -39.965 -97.986  
 Final baseline L2 (X,Y,Z)/m = -212.992 -39.937 -98.014

## COMPUTATION OF CODE DIFFERENCES

Number of code differences = 140258

Global average of individual differences

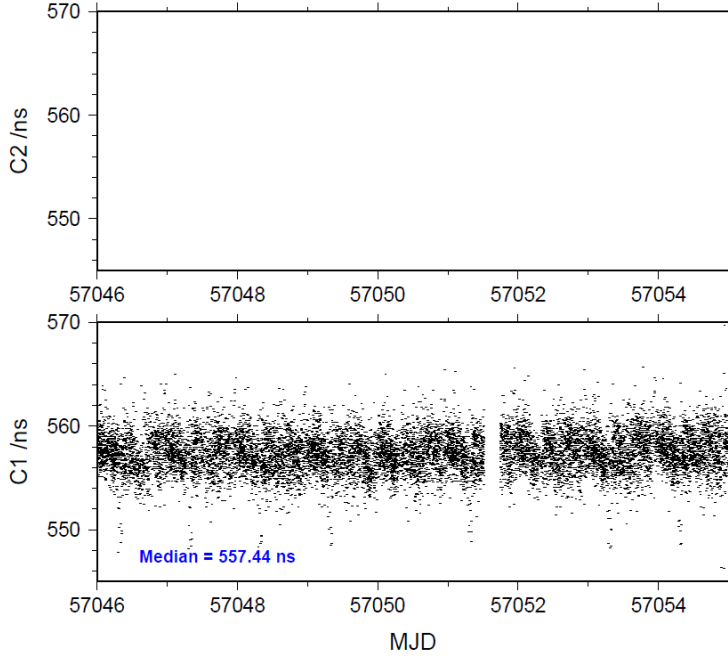
Code #pts, ave/ns, rms/ns  
 C1: 140198 557.469 2.490  
 C2: 0-NaN -NaN  
 P1: 140156 557.644 2.468  
 P2: 140154 575.218 2.764

Number of 300s epochs in out file = 2528

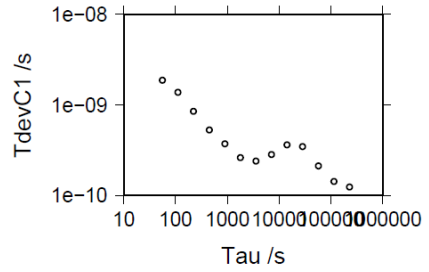
Code #pts, median/ns, ave/ns, rms/ns  
 C1: 13907 557.441 557.457 1.889  
 C2: 0 0.000-NaN -NaN  
 P1: 13906 557.576 557.608 1.616  
 P2: 13906 575.288 575.227 1.952



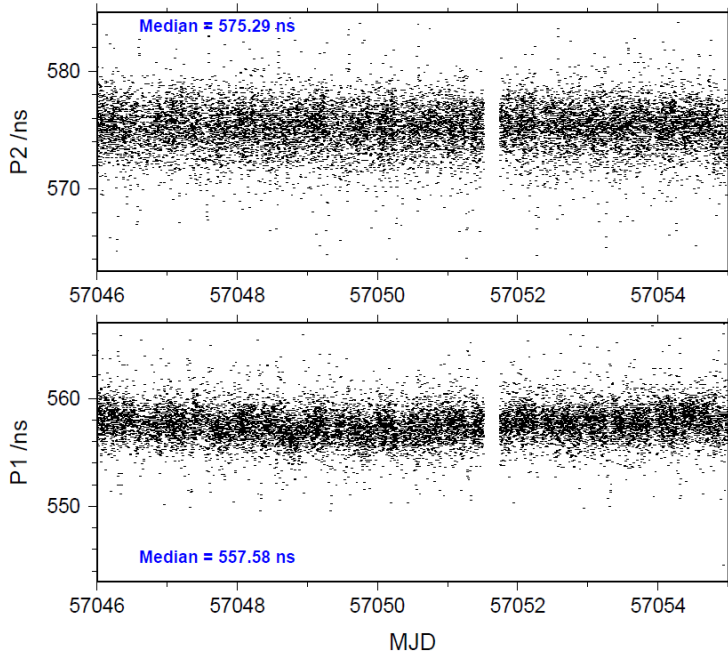
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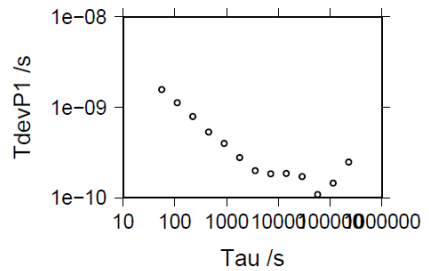
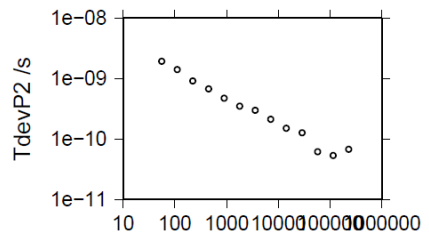
228953 s: C1= 124 ps  
 114477 s: C1= 143 ps  
 57238 s: C1= 212 ps  
 28619 s: C1= 347 ps  
 14310 s: C1= 364 ps  
 7155 s: C1= 285 ps  
 3577 s: C1= 240 ps  
 1789 s: C1= 263 ps  
 894 s: C1= 373 ps  
 447 s: C1= 529 ps  
 224 s: C1= 850 ps  
 112 s: C1= 1372 ps  
 56 s: C1= 1877 ps



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228969 s: P1= 248 ps    228969 s: P2= 68 ps  
 114485 s: P1= 145 ps    114485 s: P2= 53 ps  
 57242 s: P1= 109 ps    57242 s: P2= 62 ps  
 28621 s: P1= 173 ps    28621 s: P2= 127 ps  
 14311 s: P1= 186 ps    14311 s: P2= 151 ps  
 7155 s: P1= 185 ps    7155 s: P2= 211 ps  
 3578 s: P1= 201 ps    3578 s: P2= 298 ps  
 1789 s: P1= 280 ps    1789 s: P2= 348 ps  
 894 s: P1= 401 ps    894 s: P2= 473 ps  
 447 s: P1= 535 ps    447 s: P2= 672 ps  
 224 s: P1= 794 ps    224 s: P2= 914 ps  
 112 s: P1= 1126 ps    112 s: P2= 1415 ps  
 56 s: P1= 1570 ps    56 s: P2= 1943 ps



BP0U-NIS4

## COMPUTATION OF BASELINE

Number of codes to fit baseline and biases = 119965  
 Computed code bias (P1/P2)/m = 158.882 163.966  
 Computed baseline (X,Y,Z)/m = -216.048 -37.406 -95.959  
 RMS of residuals /m = 0.662

Number of phase differences to fit baseline = 135705  
 A priori baseline (X,Y,Z)/m = -216.048 -37.406 -95.959  
 25764 clock jitters computed out of 25842 intervals  
 AVE jitter /ps = -0.4 RMS jitter /ps = 29.3

Iter 1 Large residuals L1= 2  
 Iter 1 Large residuals L2= 2  
 Computed baseline L1 (X,Y,Z)/m = 0.107 0.097 0.076  
 RMS of residuals L1 /m = 0.003  
 Computed baseline L2 (X,Y,Z)/m = 0.113 0.124 0.049  
 RMS of residuals L2 /m = 0.003

Iter 2 Large residuals L1= 2  
 Iter 2 Large residuals L2= 2  
 Computed baseline L1 (X,Y,Z)/m = 0.107 0.097 0.076  
 RMS of residuals L1 /m = 0.003  
 Computed baseline L2 (X,Y,Z)/m = 0.113 0.124 0.049  
 RMS of residuals L2 /m = 0.003

Final baseline L1 (X,Y,Z)/m = -215.941 -37.309 -95.883  
 Final baseline L2 (X,Y,Z)/m = -215.935 -37.282 -95.910

## COMPUTATION OF CODE DIFFERENCES

Number of code differences = 144107

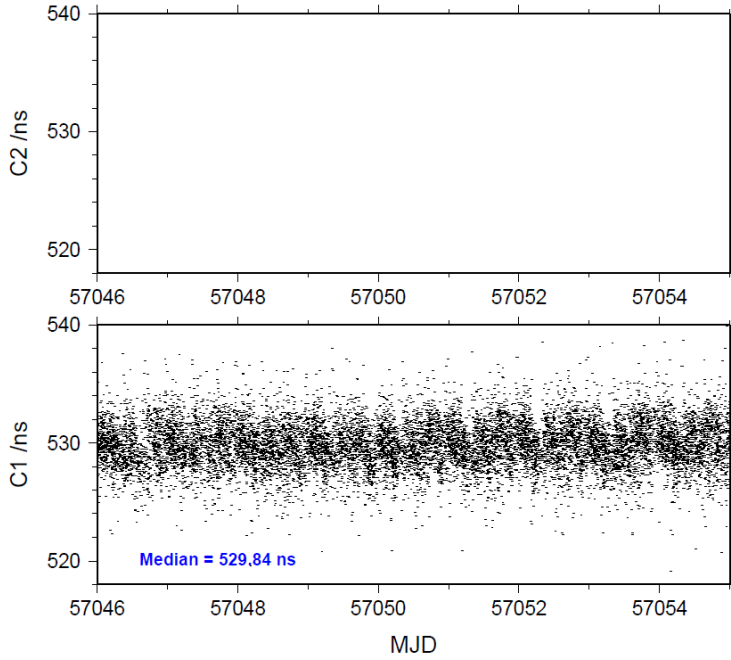
Global average of individual differences

Code #pts, ave/ns, rms/ns  
 C1: 144050 529.865 2.510  
 C2: 0-NaN -NaN  
 P1: 144007 530.037 2.512  
 P2: 144006 547.170 2.729

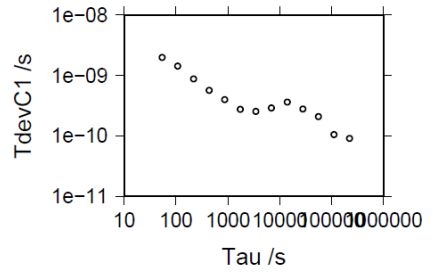
Number of 300s epochs in out file = 2592

Code #pts, median/ns, ave/ns, rms/ns  
 C1: 14291 529.836 529.854 1.962  
 C2: 0 0.000-NaN -NaN  
 P1: 14290 529.982 529.998 1.718  
 P2: 14290 547.182 547.178 1.966

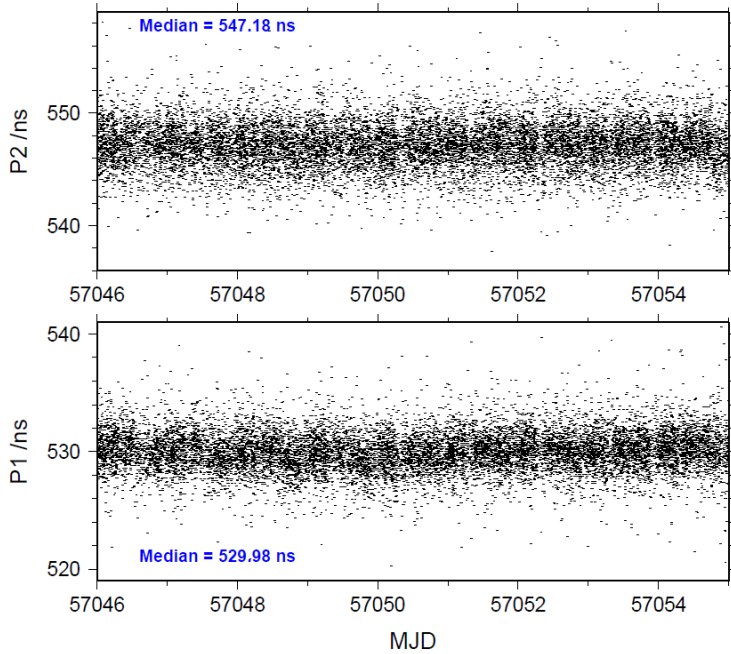
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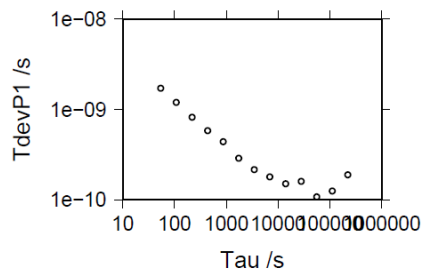
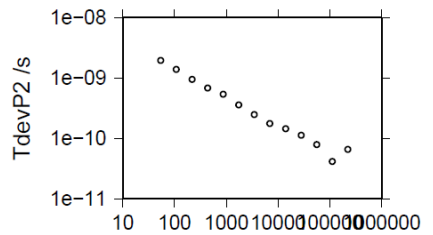
- 222801 s: C1= 92 ps
- 111400 s: C1= 106 ps
- 55700 s: C1= 209 ps
- 27850 s: C1= 279 ps
- 13925 s: C1= 362 ps
- 6963 s: C1= 292 ps
- 3481 s: C1= 254 ps
- 1741 s: C1= 276 ps
- 870 s: C1= 397 ps
- 435 s: C1= 572 ps
- 218 s: C1= 882 ps
- 109 s: C1= 1420 ps
- 54 s: C1= 1984 ps



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- 222816 s: P1= 190 ps    222816 s: P2= 66 ps
- 111408 s: P1= 125 ps    111408 s: P2= 41 ps
- 55704 s: P1= 108 ps    55704 s: P2= 79 ps
- 27852 s: P1= 160 ps    27852 s: P2= 112 ps
- 13926 s: P1= 151 ps    13926 s: P2= 145 ps
- 6963 s: P1= 179 ps    6963 s: P2= 177 ps
- 3482 s: P1= 217 ps    3482 s: P2= 249 ps
- 1741 s: P1= 289 ps    1741 s: P2= 358 ps
- 870 s: P1= 439 ps    870 s: P2= 536 ps
- 435 s: P1= 581 ps    435 s: P2= 687 ps
- 218 s: P1= 819 ps    218 s: P2= 947 ps
- 109 s: P1= 1200 ps    109 s: P2= 1390 ps
- 54 s: P1= 1719 ps    54 s: P2= 1961 ps



BP1C-NIST

## COMPUTATION OF BASELINE

Number of codes to fit baseline and biases = 123402  
 Computed code bias (P1/P2)/m = -233.644 -232.058  
 Computed baseline (X,Y,Z)/m = -67.461 -35.678 -59.552  
 RMS of residuals /m = 0.479

Number of phase differences to fit baseline = 139391  
 A priori baseline (X,Y,Z)/m = -67.461 -35.678 -59.552  
 17269 clock jitters computed out of 17269 intervals  
 AVE jitter /ps = -0.4 RMS jitter /ps = 5.2

Iter 1 Large residuals L1= 0  
 Iter 1 Large residuals L2= 0  
 Computed baseline L1 (X,Y,Z)/m = -0.016 0.103 0.007  
 RMS of residuals L1 /m = 0.004  
 Computed baseline L2 (X,Y,Z)/m = -0.003 0.102 0.003  
 RMS of residuals L2 /m = 0.005

Final baseline L1 (X,Y,Z)/m = -67.477 -35.575 -59.545  
 Final baseline L2 (X,Y,Z)/m = -67.464 -35.576 -59.549

## COMPUTATION OF CODE DIFFERENCES

Number of code differences = 141739

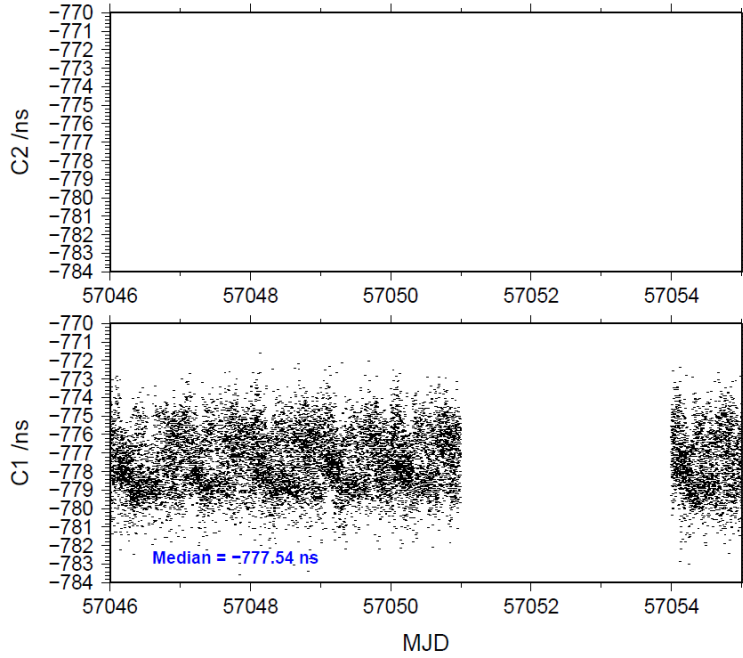
Global average of individual differences

Code #pts, ave/ns, rms/ns  
 C1: 141693 -777.434 2.053  
 C2: 0-NaN -NaN  
 P1: 141639 -779.272 1.563  
 P2: 141631 -773.897 1.956

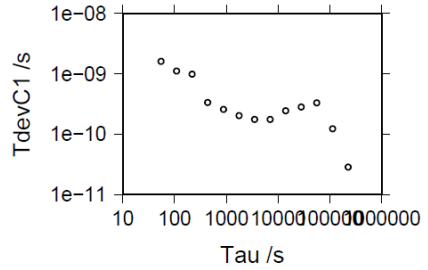
Number of 300s epochs in out file = 1728

Code #pts, median/ns, ave/ns, rms/ns  
 C1: 14160 -777.545 -777.435 1.642  
 C2: 0 0.000-NaN -NaN  
 P1: 14155 -779.242 -779.273 0.946  
 P2: 14155 -773.920 -773.896 1.343

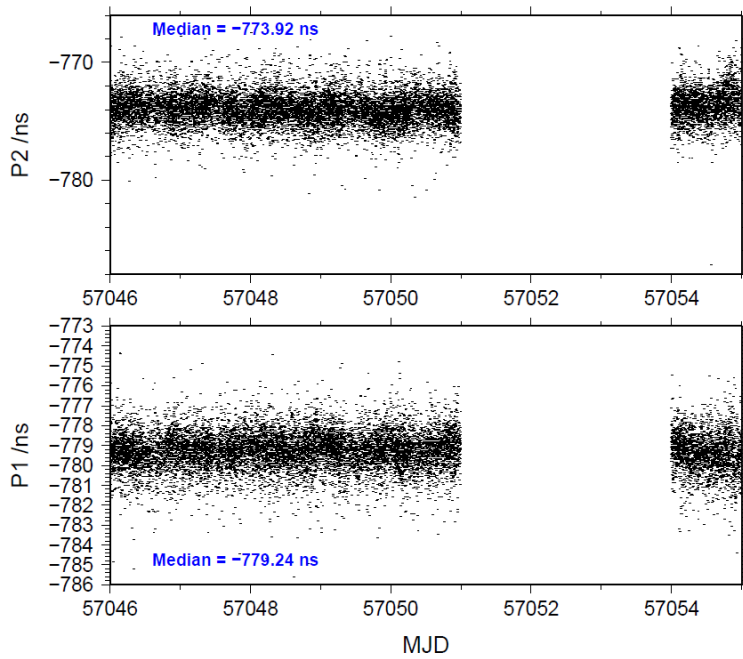
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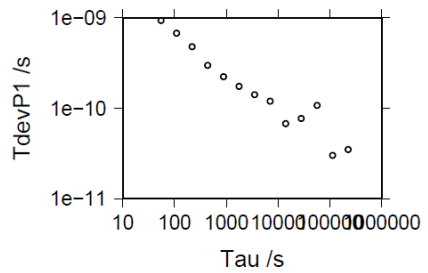
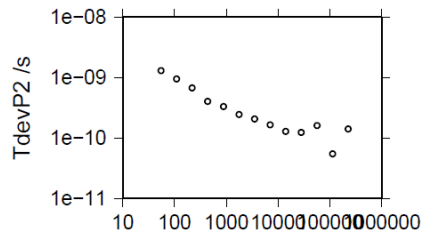
- 224862 s: C1= 29 ps
- 112431 s: C1= 124 ps
- 56216 s: C1= 332 ps
- 28108 s: C1= 284 ps
- 14054 s: C1= 244 ps
- 7027 s: C1= 177 ps
- 3513 s: C1= 176 ps
- 1757 s: C1= 202 ps
- 878 s: C1= 257 ps
- 439 s: C1= 335 ps
- 220 s: C1= 986 ps
- 110 s: C1= 1109 ps
- 55 s: C1= 1603 ps



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- 224941 s: P1= 35 ps      224941 s: P2= 140 ps
- 112471 s: P1= 30 ps      112471 s: P2= 55 ps
- 56235 s: P1= 108 ps     56235 s: P2= 160 ps
- 28118 s: P1= 77 ps      28118 s: P2= 123 ps
- 14059 s: P1= 67 ps      14059 s: P2= 128 ps
- 7029 s: P1= 119 ps      7029 s: P2= 165 ps
- 3515 s: P1= 141 ps      3515 s: P2= 207 ps
- 1757 s: P1= 175 ps      1757 s: P2= 245 ps
- 879 s: P1= 223 ps      879 s: P2= 331 ps
- 439 s: P1= 298 ps      439 s: P2= 404 ps
- 220 s: P1= 477 ps      220 s: P2= 674 ps
- 110 s: P1= 672 ps      110 s: P2= 945 ps
- 55 s: P1= 931 ps        55 s: P2= 1308 ps



BP1C-NIS3

## COMPUTATION OF BASELINE

Number of codes to fit baseline and biases = 160372  
 Computed code bias (P1/P2)/m = 179.686 184.983  
 Computed baseline (X,Y,Z)/m = -216.124 -39.799 -98.392  
 RMS of residuals /m = 0.646

Number of phase differences to fit baseline = 208570  
 A priori baseline (X,Y,Z)/m = -216.124 -39.799 -98.392  
 25260 clock jitters computed out of 25260 intervals  
 AVE jitter /ps = -0.6 RMS jitter /ps = 5.5

Iter 1 Large residuals L1= 1  
 Iter 1 Large residuals L2= 1  
 Computed baseline L1 (X,Y,Z)/m = 0.069 0.311 -0.074  
 RMS of residuals L1 /m = 0.004  
 Computed baseline L2 (X,Y,Z)/m = 0.065 0.320 -0.081  
 RMS of residuals L2 /m = 0.005

Iter 2 Large residuals L1= 1  
 Iter 2 Large residuals L2= 1  
 Computed baseline L1 (X,Y,Z)/m = 0.069 0.311 -0.074  
 RMS of residuals L1 /m = 0.004  
 Computed baseline L2 (X,Y,Z)/m = 0.065 0.320 -0.081  
 RMS of residuals L2 /m = 0.005

Final baseline L1 (X,Y,Z)/m = -216.054 -39.487 -98.466  
 Final baseline L2 (X,Y,Z)/m = -216.059 -39.478 -98.473

## COMPUTATION OF CODE DIFFERENCES

Number of code differences = 210879

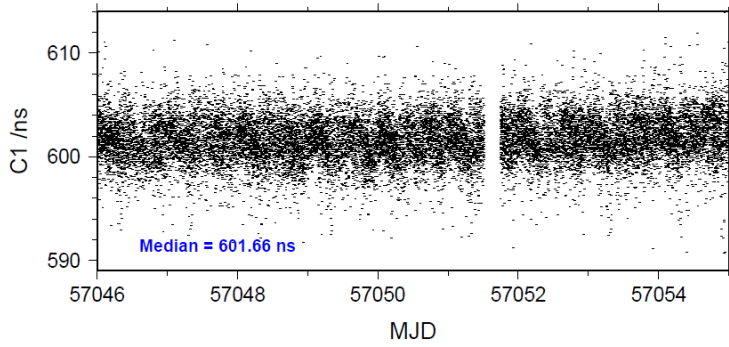
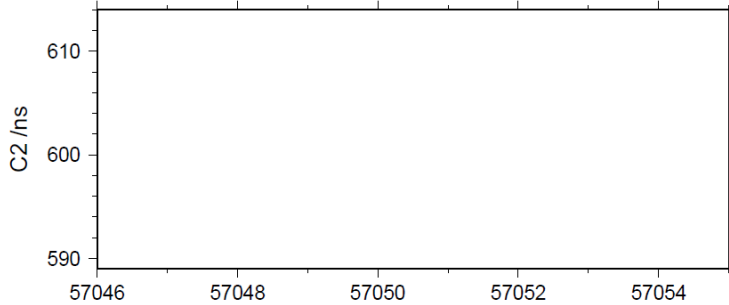
Global average of individual differences

Code #pts, ave/ns, rms/ns  
 C1: 210815 601.725 2.816  
 C2: 0-NaN -NaN  
 P1: 210712 599.898 2.494  
 P2: 210637 617.552 2.857

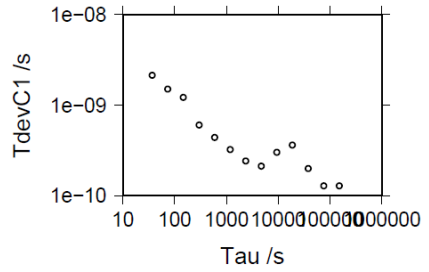
Number of 300s epochs in out file = 2528

Code #pts, median/ns, ave/ns, rms/ns  
 C1: 21049 601.661 601.709 2.184  
 C2: 0 0.000-NaN -NaN  
 P1: 21036 599.950 599.881 1.736  
 P2: 21030 617.598 617.534 2.085

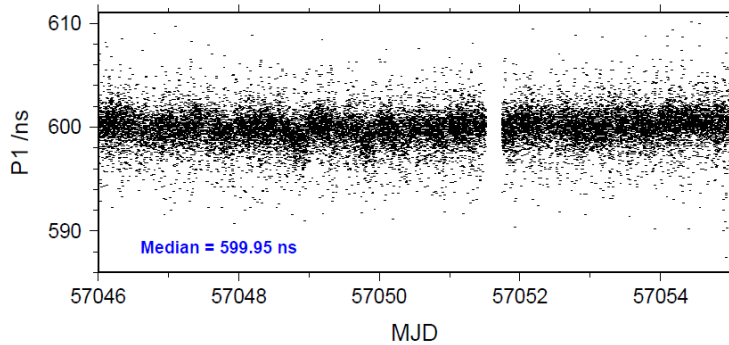
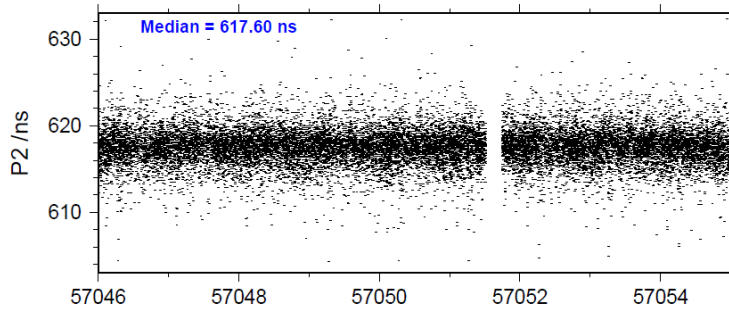
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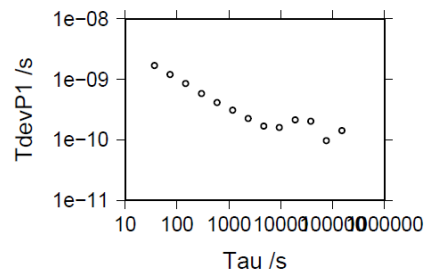
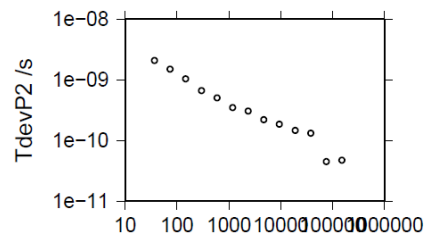
- 151265 s: C1= 129 ps
- 75632 s: C1= 129 ps
- 37816 s: C1= 201 ps
- 18908 s: C1= 362 ps
- 9454 s: C1= 301 ps
- 4727 s: C1= 213 ps
- 2364 s: C1= 243 ps
- 1182 s: C1= 324 ps
- 591 s: C1= 442 ps
- 295 s: C1= 606 ps
- 148 s: C1= 1216 ps
- 74 s: C1= 1501 ps
- 37 s: C1= 2139 ps



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- |                      |                     |
|----------------------|---------------------|
| 151358 s: P1= 142 ps | 151401 s: P2= 48 ps |
| 75679 s: P1= 97 ps   | 75701 s: P2= 45 ps  |
| 37840 s: P1= 204 ps  | 37850 s: P2= 132 ps |
| 18920 s: P1= 214 ps  | 18925 s: P2= 147 ps |
| 9460 s: P1= 161 ps   | 9463 s: P2= 185 ps  |
| 4730 s: P1= 168 ps   | 4731 s: P2= 220 ps  |
| 2365 s: P1= 227 ps   | 2366 s: P2= 305 ps  |
| 1182 s: P1= 309 ps   | 1183 s: P2= 348 ps  |
| 591 s: P1= 414 ps    | 591 s: P2= 504 ps   |
| 296 s: P1= 580 ps    | 296 s: P2= 665 ps   |
| 148 s: P1= 851 ps    | 148 s: P2= 1034 ps  |
| 74 s: P1= 1207 ps    | 74 s: P2= 1498 ps   |
| 37 s: P1= 1701 ps    | 37 s: P2= 2090 ps   |



BP1C-NIS4

## COMPUTATION OF BASELINE

Number of codes to fit baseline and biases = 167444  
 Computed code bias (P1/P2)/m = 171.510 176.663  
 Computed baseline (X,Y,Z)/m = -219.045 -37.067 -96.388  
 RMS of residuals /m = 0.654

Number of phase differences to fit baseline = 214017  
 A priori baseline (X,Y,Z)/m = -219.045 -37.067 -96.388  
 25910 clock jitters computed out of 25910 intervals  
 AVE jitter /ps = -0.6 RMS jitter /ps = 5.8

Iter 1 Large residuals L1= 1  
 Iter 1 Large residuals L2= 2  
 Computed baseline L1 (X,Y,Z)/m = 0.043 0.237 0.032  
 RMS of residuals L1 /m = 0.005  
 Computed baseline L2 (X,Y,Z)/m = 0.043 0.243 0.024  
 RMS of residuals L2 /m = 0.005

Iter 2 Large residuals L1= 1  
 Iter 2 Large residuals L2= 2  
 Computed baseline L1 (X,Y,Z)/m = 0.043 0.237 0.032  
 RMS of residuals L1 /m = 0.005  
 Computed baseline L2 (X,Y,Z)/m = 0.043 0.243 0.024  
 RMS of residuals L2 /m = 0.005

Final baseline L1 (X,Y,Z)/m = -219.003 -36.830 -96.356  
 Final baseline L2 (X,Y,Z)/m = -219.003 -36.824 -96.364

## COMPUTATION OF CODE DIFFERENCES

Number of code differences = 216335

Global average of individual differences

Code #pts, ave/ns, rms/ns

C1: 216269 574.157 2.911

C2: 0-NaN -NaN

P1: 216166 572.328 2.622

P2: 216089 589.577 2.834

Number of 300s epochs in out file = 2592

Code #pts, median/ns, ave/ns, rms/ns

C1: 21596 574.119 574.137 2.264

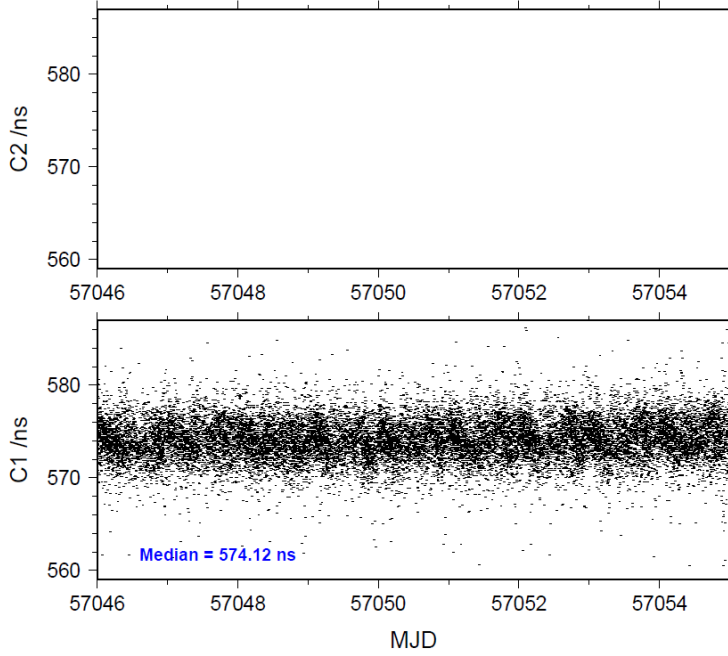
C2: 0 0.000-NaN -NaN

P1: 21583 572.353 572.305 1.866

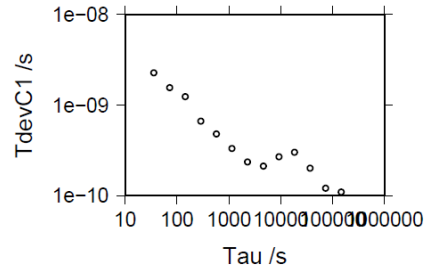
P2: 21581 589.561 589.545 2.132



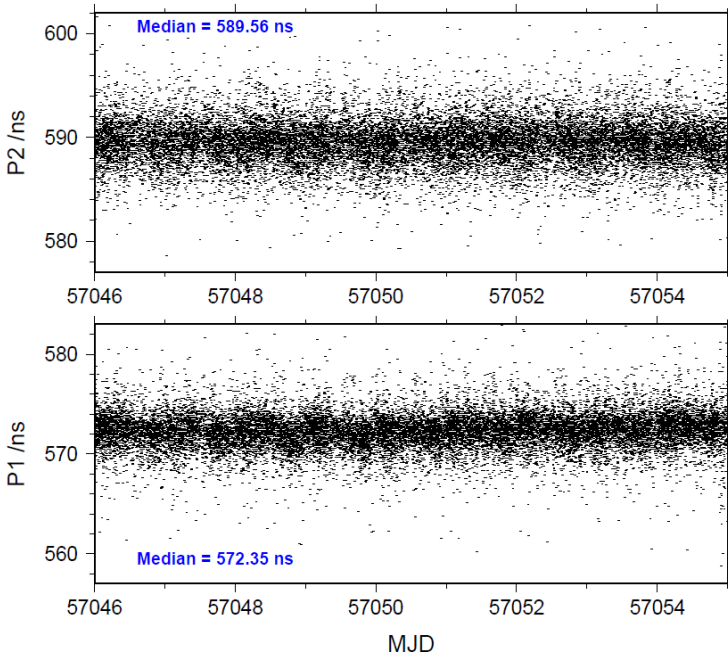
03/18/15 bp1cnis415024\_9



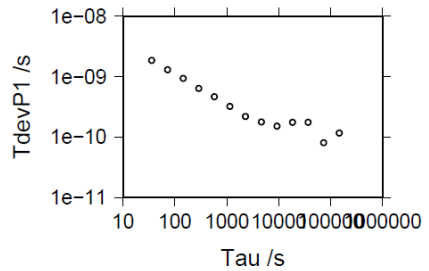
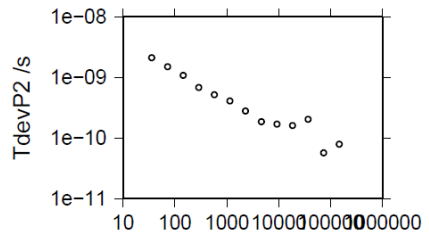
147433 s: C1= 110 ps  
 73717 s: C1= 121 ps  
 36858 s: C1= 202 ps  
 18429 s: C1= 303 ps  
 9215 s: C1= 270 ps  
 4607 s: C1= 212 ps  
 2304 s: C1= 237 ps  
 1152 s: C1= 332 ps  
 576 s: C1= 482 ps  
 288 s: C1= 662 ps  
 144 s: C1= 1236 ps  
 72 s: C1= 1555 ps  
 36 s: C1= 2263 ps



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147522 s: P1= 117 ps    147536 s: P2= 79 ps  
 73761 s: P1= 81 ps    73768 s: P2= 57 ps  
 36881 s: P1= 176 ps    36884 s: P2= 203 ps  
 18440 s: P1= 176 ps    18442 s: P2= 162 ps  
 9220 s: P1= 152 ps    9221 s: P2= 170 ps  
 4610 s: P1= 179 ps    4610 s: P2= 187 ps  
 2305 s: P1= 221 ps    2305 s: P2= 281 ps  
 1153 s: P1= 324 ps    1153 s: P2= 407 ps  
 576 s: P1= 464 ps    576 s: P2= 519 ps  
 288 s: P1= 642 ps    288 s: P2= 681 ps  
 144 s: P1= 938 ps    144 s: P2= 1085 ps  
 72 s: P1= 1296 ps    72 s: P2= 1508 ps  
 36 s: P1= 1845 ps    36 s: P2= 2125 ps



**4.3/ USNO (15069)**Period

MJD 57091 to 57097

Delays

## BP0U:

|                           |                                 |
|---------------------------|---------------------------------|
| REFDLY = $X_P$ = 118.8 ns | (66.2+C166+BP1I+C153=66.2+52.6) |
| CABDLY = $X_C$ = 182.0 ns | (C134)                          |

## BP1C:

|                           |                                 |
|---------------------------|---------------------------------|
| $X_O$ = 203.26 ns         | (218.114-14.854)                |
| $X_P$ = 118.8 ns          | (66.2+C166+BP1I+C153=66.2+52.6) |
| REFDLY = 322.06 ns        |                                 |
| CABDLY = $X_C$ = 235.7 ns | (C131)                          |

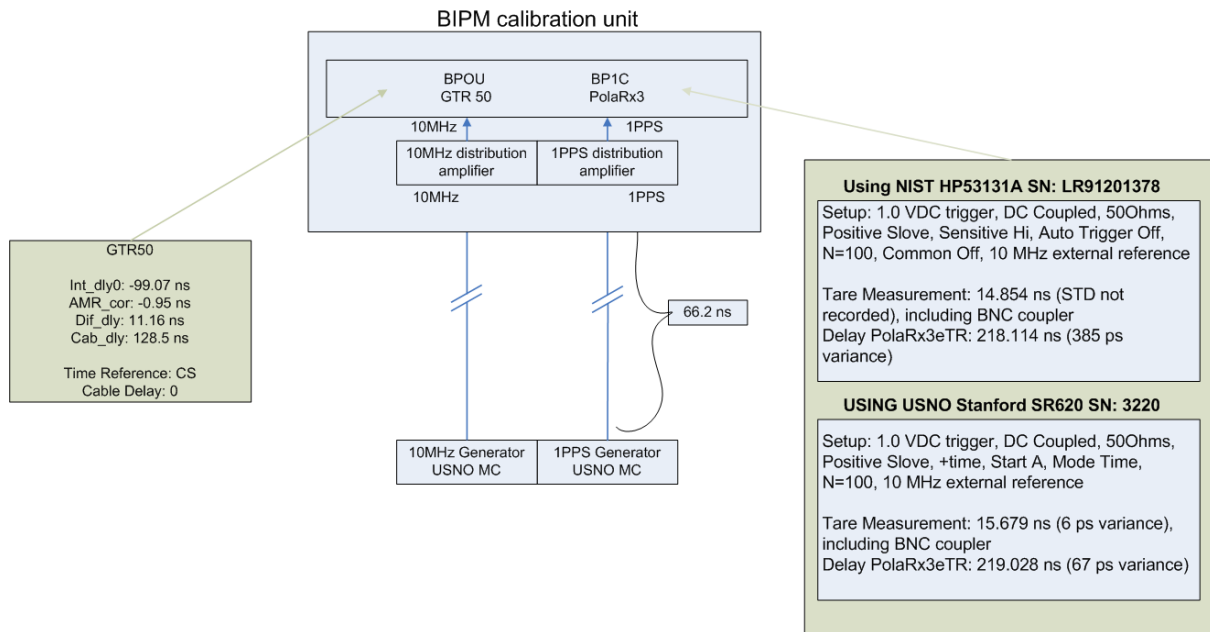
## USN6:

|                 |
|-----------------|
| REFDLY = 0.0 ns |
| CABDLY = 0.0 ns |

## USN7:

|                 |
|-----------------|
| REFDLY = 0.0 ns |
| CABDLY = 0.0 ns |

Setup at the USNO



BP0U-USN6

## COMPUTATION OF BASELINE

Number of codes to fit baseline and biases = 92248  
 Computed code bias (P1/P2)/m = -20.003 -17.387  
 Computed baseline (X,Y,Z)/m = -5.125 -0.944 -0.421  
 RMS of residuals /m = 0.497

Number of phase differences to fit baseline = 86783  
 A priori baseline (X,Y,Z)/m = -5.125 -0.944 -0.421  
 17204 clock jitters computed out of 17225 intervals  
 AVE jitter /ps = -0.2 RMS jitter /ps = 31.7

Iter 1 Large residuals L1= 0  
 Iter 1 Large residuals L2= 0  
 Computed baseline L1 (X,Y,Z)/m = 0.015 -0.138 0.089  
 RMS of residuals L1 /m = 0.003  
 Computed baseline L2 (X,Y,Z)/m = 0.014 -0.152 0.097  
 RMS of residuals L2 /m = 0.003

Final baseline L1 (X,Y,Z)/m = -5.110 -1.083 -0.332  
 Final baseline L2 (X,Y,Z)/m = -5.111 -1.096 -0.324

## COMPUTATION OF CODE DIFFERENCES

Number of code differences = 92250

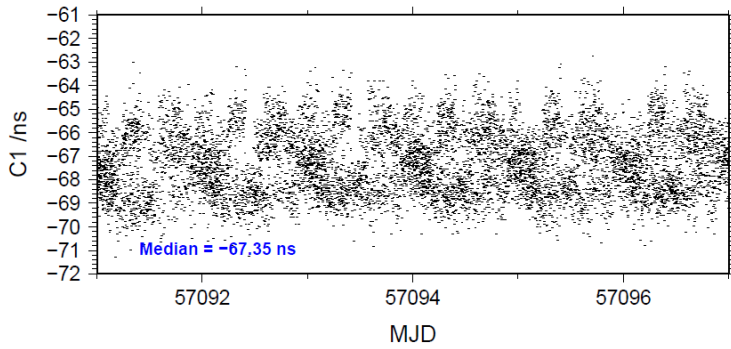
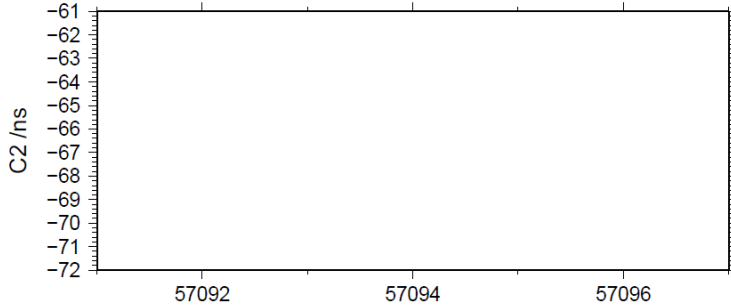
Global average of individual differences

Code #pts, ave/ns, rms/ns  
 C1: 92196 -67.259 1.708  
 C2: 0-NaN -NaN  
 P1: 92194 -67.103 1.654  
 P2: 92193 -58.416 1.775

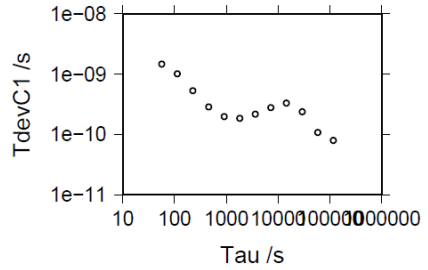
Number of 300s epochs in out file = 1728

Code #pts, median/ns, ave/ns, rms/ns  
 C1: 9120 -67.348 -67.266 1.384  
 C2: 0 0.000-NaN -NaN  
 P1: 9120 -67.182 -67.136 0.823  
 P2: 9120 -58.412 -58.410 0.853

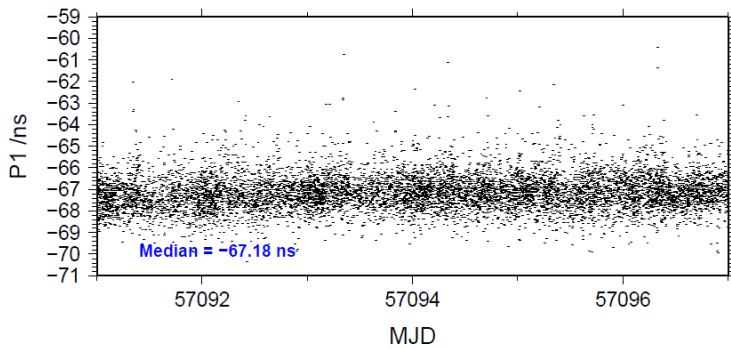
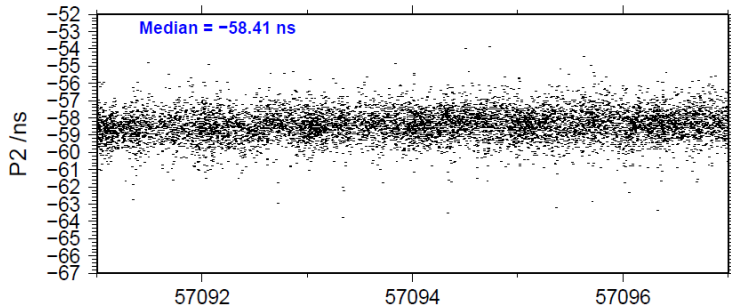
03/17/15 bp0uusn615069\_6



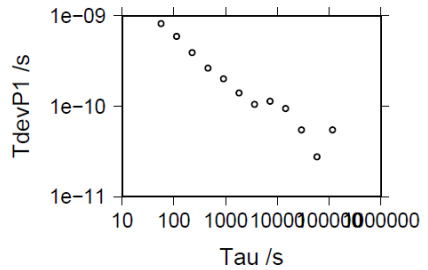
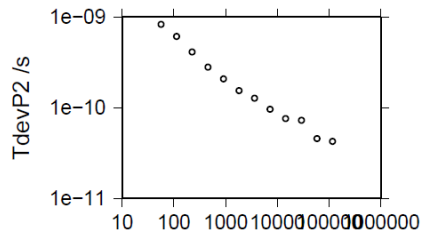
116358 s: C1= 80 ps  
 58179 s: C1= 108 ps  
 29090 s: C1= 237 ps  
 14545 s: C1= 331 ps  
 7272 s: C1= 279 ps  
 3636 s: C1= 218 ps  
 1818 s: C1= 185 ps  
 909 s: C1= 199 ps  
 455 s: C1= 285 ps  
 227 s: C1= 531 ps  
 114 s: C1= 1010 ps  
 57 s: C1= 1460 ps



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116358 s: P1= 55 ps    116358 s: P2= 43 ps  
 58179 s: P1= 28 ps    58179 s: P2= 46 ps  
 29090 s: P1= 55 ps    29090 s: P2= 73 ps  
 14545 s: P1= 94 ps    14545 s: P2= 76 ps  
 7272 s: P1= 114 ps    7272 s: P2= 97 ps  
 3636 s: P1= 105 ps    3636 s: P2= 128 ps  
 1818 s: P1= 140 ps    1818 s: P2= 155 ps  
 909 s: P1= 200 ps    909 s: P2= 209 ps  
 455 s: P1= 263 ps    455 s: P2= 280 ps  
 227 s: P1= 390 ps    227 s: P2= 414 ps  
 114 s: P1= 591 ps    114 s: P2= 614 ps  
 57 s: P1= 819 ps    57 s: P2= 831 ps



BP0U-USN7

## COMPUTATION OF BASELINE

Number of codes to fit baseline and biases = 92493  
 Computed code bias (P1/P2)/m = -20.227 -17.673  
 Computed baseline (X,Y,Z)/m = -5.170 -1.109 -0.350  
 RMS of residuals /m = 0.578

Number of phase differences to fit baseline = 86990  
 A priori baseline (X,Y,Z)/m = -5.170 -1.109 -0.350  
 17202 clock jitters computed out of 17218 intervals  
 AVE jitter /ps = 0.1 RMS jitter /ps = 31.7

Iter 1 Large residuals L1= 0  
 Iter 1 Large residuals L2= 0  
 Computed baseline L1 (X,Y,Z)/m = 0.012 -0.004 0.026  
 RMS of residuals L1 /m = 0.003  
 Computed baseline L2 (X,Y,Z)/m = 0.013 -0.016 0.034  
 RMS of residuals L2 /m = 0.003

Final baseline L1 (X,Y,Z)/m = -5.158 -1.113 -0.324  
 Final baseline L2 (X,Y,Z)/m = -5.158 -1.126 -0.317

## COMPUTATION OF CODE DIFFERENCES

Number of code differences = 92502

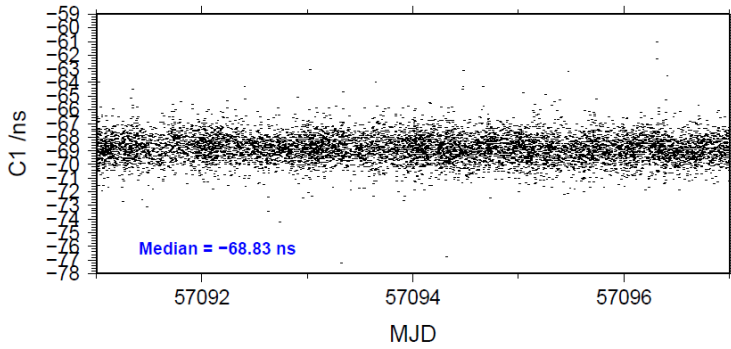
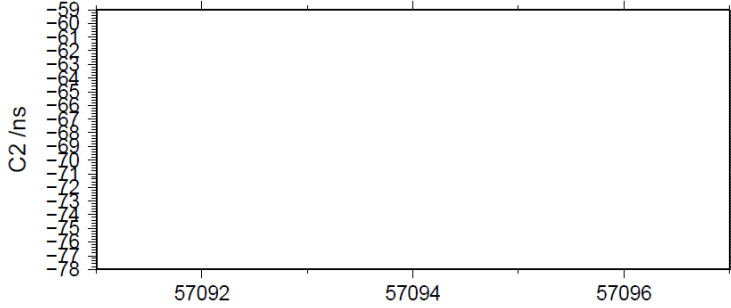
Global average of individual differences

Code #pts, ave/ns, rms/ns  
 C1: 92444 -68.779 2.326  
 C2: 0-NaN -NaN  
 P1: 92439 -67.510 2.048  
 P2: 92182 -58.886 2.138

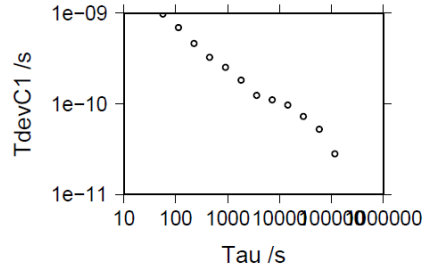
Number of 300s epochs in out file = 1728

Code #pts, median/ns, ave/ns, rms/ns  
 C1: 9145 -68.831 -68.816 0.976  
 C2: 0 0.000-NaN -NaN  
 P1: 9145 -67.599 -67.552 0.918  
 P2: 9120 -58.883 -58.879 0.911

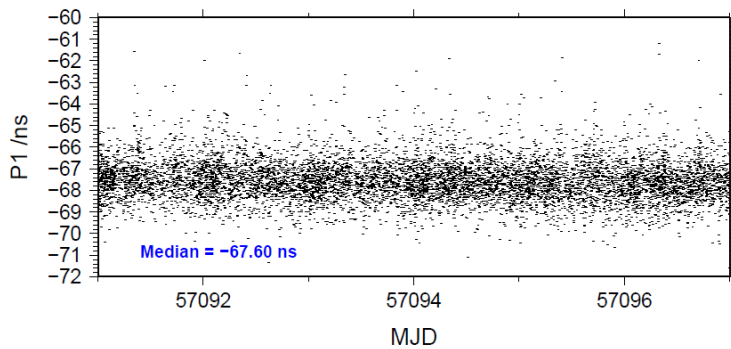
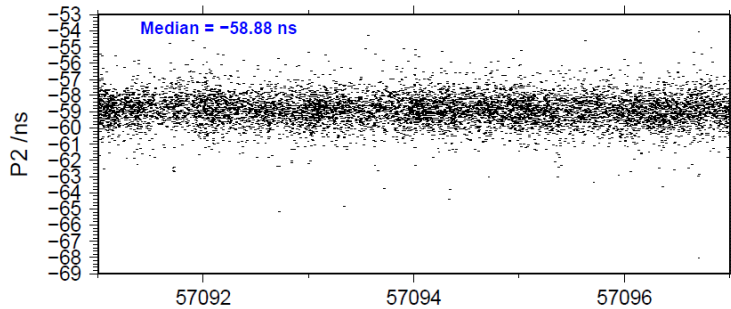
03/18/15 bp0uusn715069\_6



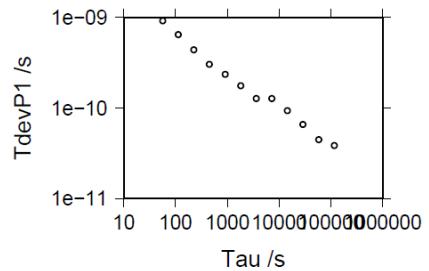
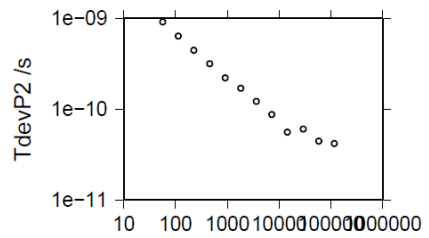
116040 s: C1= 28 ps  
 58020 s: C1= 53 ps  
 29010 s: C1= 72 ps  
 14505 s: C1= 97 ps  
 7252 s: C1= 110 ps  
 3626 s: C1= 123 ps  
 1813 s: C1= 183 ps  
 907 s: C1= 253 ps  
 453 s: C1= 326 ps  
 227 s: C1= 463 ps  
 113 s: C1= 695 ps  
 57 s: C1= 977 ps



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116040 s: P1= 39 ps    116358 s: P2= 42 ps  
 58020 s: P1= 45 ps    58179 s: P2= 44 ps  
 29010 s: P1= 66 ps    29090 s: P2= 60 ps  
 14505 s: P1= 94 ps    14545 s: P2= 56 ps  
 7252 s: P1= 127 ps    7272 s: P2= 87 ps  
 3626 s: P1= 127 ps    3636 s: P2= 122 ps  
 1813 s: P1= 176 ps    1818 s: P2= 170 ps  
 907 s: P1= 234 ps    909 s: P2= 221 ps  
 453 s: P1= 304 ps    455 s: P2= 316 ps  
 227 s: P1= 437 ps    227 s: P2= 447 ps  
 113 s: P1= 645 ps    114 s: P2= 639 ps  
 57 s: P1= 918 ps    57 s: P2= 916 ps



BP1C-USN6

## COMPUTATION OF BASELINE

Number of codes to fit baseline and biases = 148014  
 Computed code bias (P1/P2)/m = -9.452 -6.884  
 Computed baseline (X,Y,Z)/m = -4.352 -0.900 -0.330  
 RMS of residuals /m = 0.416

Number of phase differences to fit baseline = 146824  
 A priori baseline (X,Y,Z)/m = -4.352 -0.900 -0.330  
 17276 clock jitters computed out of 17276 intervals  
 AVE jitter /ps = 0.0 RMS jitter /ps = 4.8

Iter 1 Large residuals L1= 0  
 Iter 1 Large residuals L2= 1  
 Computed baseline L1 (X,Y,Z)/m = -0.008 -0.025 -0.023  
 RMS of residuals L1 /m = 0.004  
 Computed baseline L2 (X,Y,Z)/m = -0.005 -0.024 -0.024  
 RMS of residuals L2 /m = 0.004

Iter 2 Large residuals L1= 0  
 Iter 2 Large residuals L2= 1  
 Computed baseline L1 (X,Y,Z)/m = -0.008 -0.025 -0.023  
 RMS of residuals L1 /m = 0.004  
 Computed baseline L2 (X,Y,Z)/m = -0.005 -0.024 -0.024  
 RMS of residuals L2 /m = 0.004

Final baseline L1 (X,Y,Z)/m = -4.360 -0.925 -0.353  
 Final baseline L2 (X,Y,Z)/m = -4.358 -0.923 -0.354

## COMPUTATION OF CODE DIFFERENCES

Number of code differences = 148260

Global average of individual differences

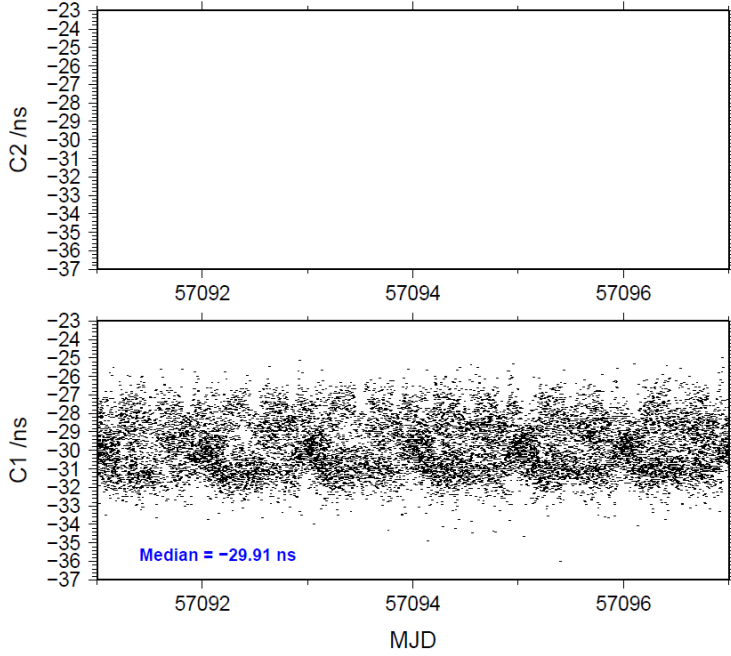
Code #pts, ave/ns, rms/ns  
 C1: 148188 -29.791 1.817  
 C2: 0-NaN -NaN  
 P1: 147949 -31.534 1.317  
 P2: 147939 -22.964 1.526

Number of 300s epochs in out file = 1728

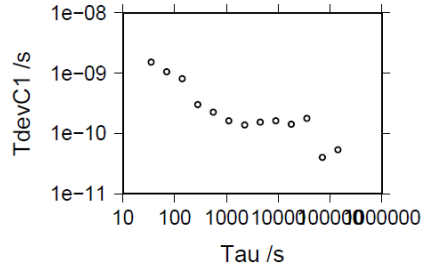
Code #pts, median/ns, ave/ns, rms/ns  
 C1: 14807 -29.914 -29.789 1.464  
 C2: 0 0.000-NaN -NaN  
 P1: 14782 -31.541 -31.532 0.746  
 P2: 14781 -22.966 -22.962 0.909



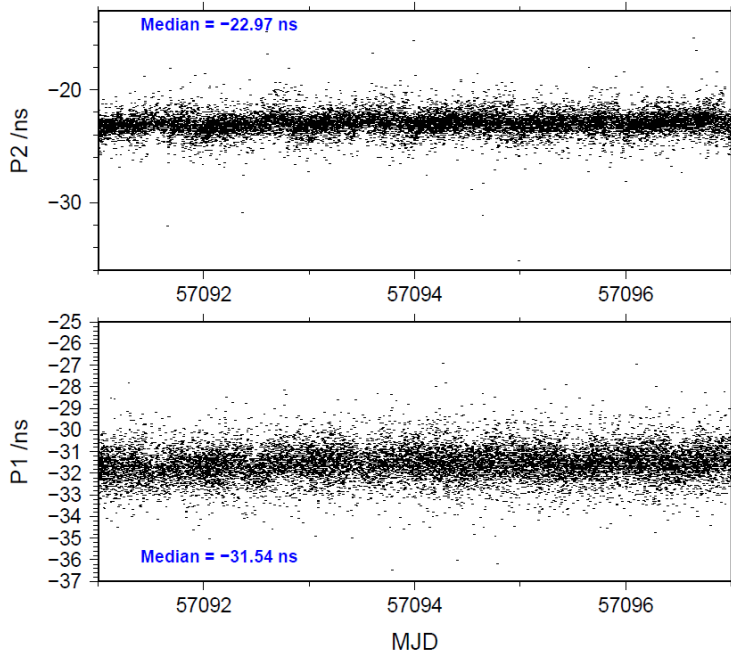
03/17/15 bp1cusn615069\_6



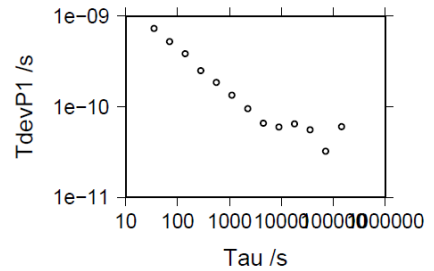
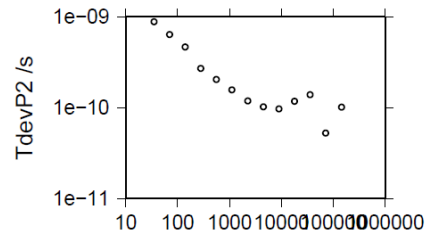
- 143330 s: C1= 54 ps
- 71665 s: C1= 40 ps
- 35832 s: C1= 178 ps
- 17916 s: C1= 143 ps
- 8958 s: C1= 163 ps
- 4479 s: C1= 155 ps
- 2240 s: C1= 139 ps
- 1120 s: C1= 163 ps
- 560 s: C1= 226 ps
- 280 s: C1= 304 ps
- 140 s: C1= 807 ps
- 70 s: C1= 1049 ps
- 35 s: C1= 1522 ps



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- 143572 s: P1= 60 ps
- 71786 s: P1= 32 ps
- 35893 s: P1= 56 ps
- 17946 s: P1= 65 ps
- 8973 s: P1= 60 ps
- 4487 s: P1= 66 ps
- 2243 s: P1= 95 ps
- 1122 s: P1= 134 ps
- 561 s: P1= 186 ps
- 280 s: P1= 250 ps
- 140 s: P1= 386 ps
- 70 s: P1= 523 ps
- 35 s: P1= 727 ps
- 143582 s: P2= 101 ps
- 71791 s: P2= 53 ps
- 35896 s: P2= 139 ps
- 17948 s: P2= 117 ps
- 8974 s: P2= 97 ps
- 4487 s: P2= 102 ps
- 2243 s: P2= 119 ps
- 1122 s: P2= 158 ps
- 561 s: P2= 204 ps
- 280 s: P2= 270 ps
- 140 s: P2= 468 ps
- 70 s: P2= 637 ps
- 35 s: P2= 887 ps



BP1C-USN7

## COMPUTATION OF BASELINE

Number of codes to fit baseline and biases = 145458  
 Computed code bias (P1/P2)/m = -9.569 -7.072  
 Computed baseline (X,Y,Z)/m = -4.400 -0.948 -0.327  
 RMS of residuals /m = 0.623

Number of phase differences to fit baseline = 145071  
 A priori baseline (X,Y,Z)/m = -4.400 -0.948 -0.327  
 17276 clock jitters computed out of 17276 intervals  
 AVE jitter /ps = 0.1 RMS jitter /ps = 5.2

Iter 1 Large residuals L1= 0  
 Iter 1 Large residuals L2= 1  
 Computed baseline L1 (X,Y,Z)/m = 0.026 0.016 -0.025  
 RMS of residuals L1 /m = 0.004  
 Computed baseline L2 (X,Y,Z)/m = 0.030 0.020 -0.027  
 RMS of residuals L2 /m = 0.004

Iter 2 Large residuals L1= 0  
 Iter 2 Large residuals L2= 1  
 Computed baseline L1 (X,Y,Z)/m = 0.026 0.016 -0.025  
 RMS of residuals L1 /m = 0.004  
 Computed baseline L2 (X,Y,Z)/m = 0.030 0.020 -0.027  
 RMS of residuals L2 /m = 0.004

Final baseline L1 (X,Y,Z)/m = -4.373 -0.932 -0.352  
 Final baseline L2 (X,Y,Z)/m = -4.369 -0.928 -0.354

## COMPUTATION OF CODE DIFFERENCES

Number of code differences = 146761

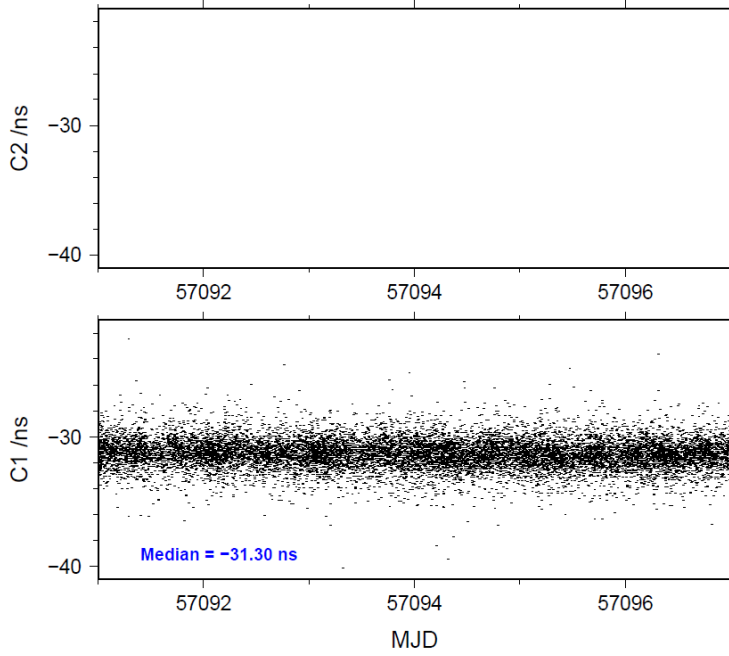
Global average of individual differences

Code #pts, ave/ns, rms/ns  
 C1: 146408 -31.273 3.047  
 C2: 0-NaN -NaN  
 P1: 145540 -31.878 2.386  
 P2: 145091 -23.387 2.498

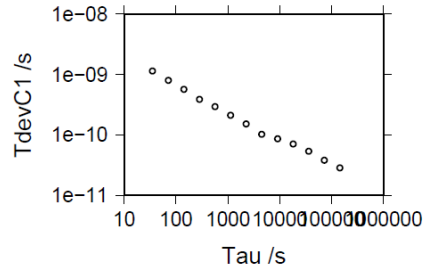
Number of 300s epochs in out file = 1728

Code #pts, median/ns, ave/ns, rms/ns  
 C1: 14629 -31.296 -31.302 1.141  
 C2: 0 0.000-NaN -NaN  
 P1: 14554 -31.922 -31.902 0.976  
 P2: 14505 -23.413 -23.411 1.013

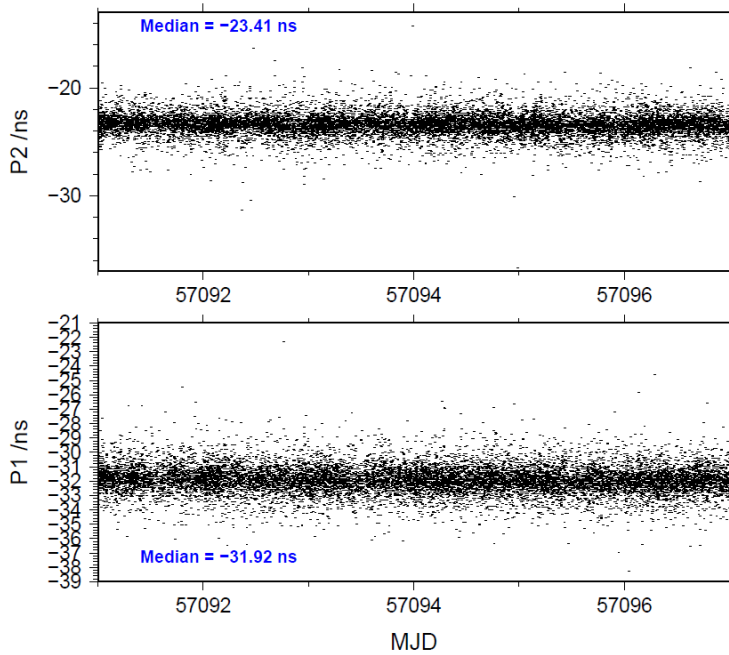
03/18/15 bp1cusn715069\_6



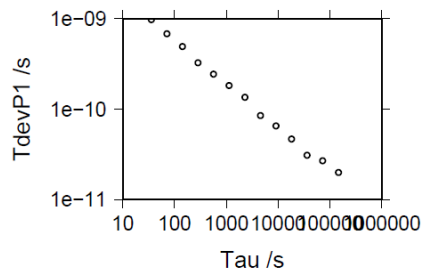
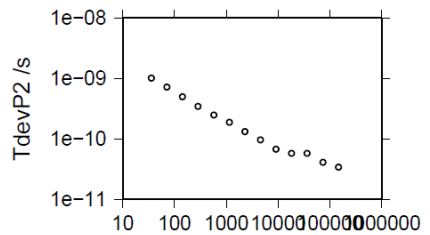
- 145074 s: C1= 29 ps
- 72537 s: C1= 38 ps
- 36268 s: C1= 54 ps
- 18134 s: C1= 71 ps
- 9067 s: C1= 86 ps
- 4534 s: C1= 103 ps
- 2267 s: C1= 153 ps
- 1133 s: C1= 212 ps
- 567 s: C1= 292 ps
- 283 s: C1= 388 ps
- 142 s: C1= 566 ps
- 71 s: C1= 801 ps
- 35 s: C1= 1140 ps



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- 145821 s: P1= 20 ps
- 72911 s: P1= 27 ps
- 36455 s: P1= 31 ps
- 18228 s: P1= 47 ps
- 9114 s: P1= 65 ps
- 4557 s: P1= 85 ps
- 2278 s: P1= 135 ps
- 1139 s: P1= 182 ps
- 570 s: P1= 244 ps
- 285 s: P1= 326 ps
- 142 s: P1= 492 ps
- 71 s: P1= 682 ps
- 36 s: P1= 978 ps
- 146314 s: P2= 34 ps
- 73157 s: P2= 41 ps
- 36578 s: P2= 58 ps
- 18289 s: P2= 58 ps
- 9145 s: P2= 68 ps
- 4572 s: P2= 96 ps
- 2286 s: P2= 132 ps
- 1143 s: P2= 189 ps
- 572 s: P2= 247 ps
- 286 s: P2= 346 ps
- 143 s: P2= 499 ps
- 71 s: P2= 715 ps
- 36 s: P2= 1013 ps



**4.4/ BIPM (15105)**Period

MJD 57127 to 57132

Delays

All measurements at BIPM carried out by L. Tisserand.

Equipment used to measure internal delay of local receiver is a time interval counter (TIC), model SR620, maker Stanford Research Systems, s/n: 4680, with measurement uncertainty typically less than 0.5 ns (using external reference frequency as timebase).

Equipment used to measure internal delay of traveling receivers is a time interval counter (TIC), model HP53131A, maker Agilent, s/n: KR91201378, with measurement uncertainty typically less than 1.5 ns.

## BP0R:

|                           |                      |
|---------------------------|----------------------|
| $X_O = 230.99$ ns         | (271.01-48.72+8.7)   |
| $X_P = 42.7$ ns           | (BP1R+C139+BP1S+C72) |
| REFDLY = 273.69 ns        |                      |
| CABDLY = $X_C = 133.4$ ns | (C113)               |

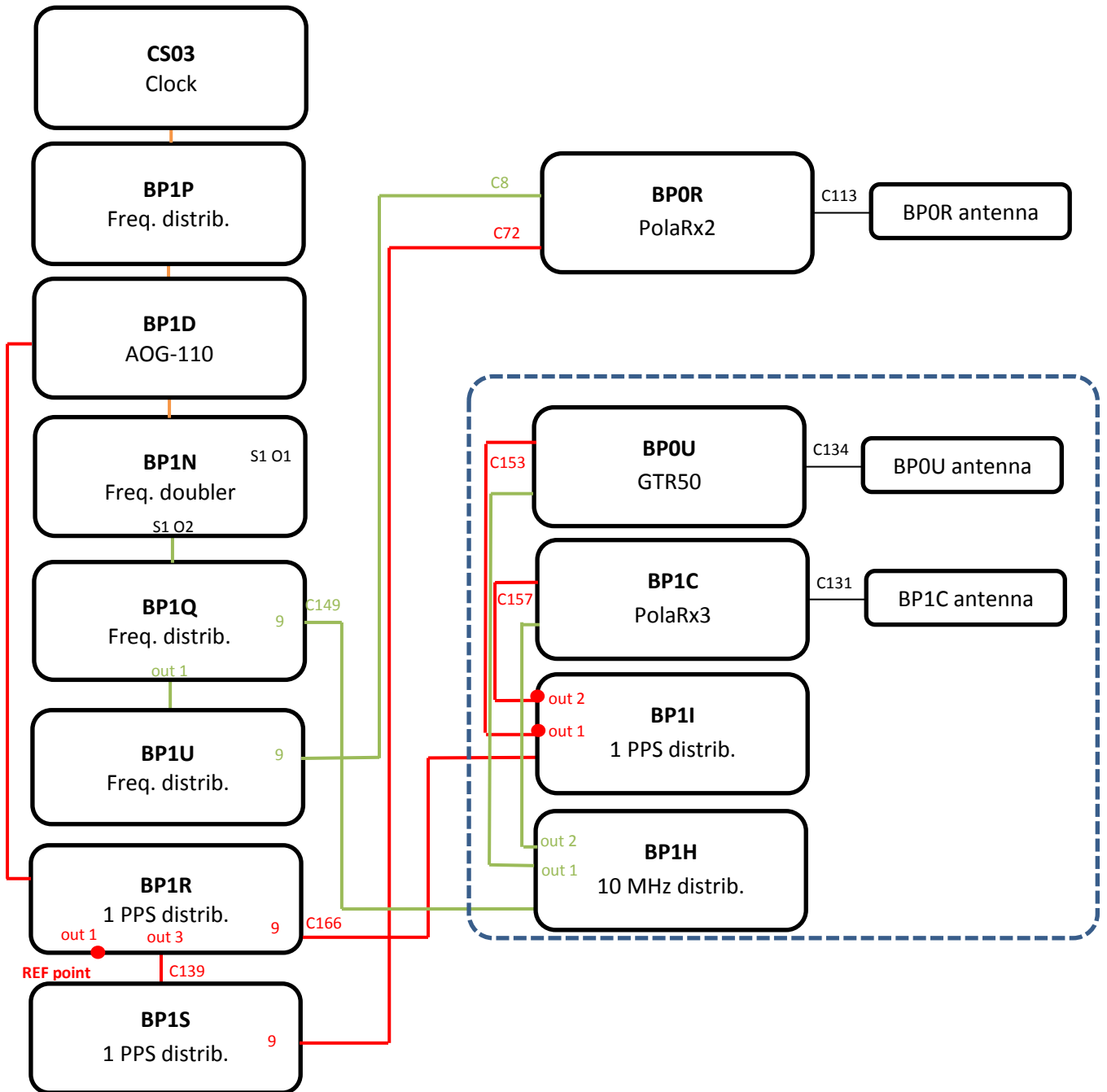
## BP0U:

|                           |                       |
|---------------------------|-----------------------|
| REFDLY = $X_P = 52.6$ ns  | (BP1R+C166+BP1I+C153) |
| CABDLY = $X_C = 182.0$ ns | (C134)                |

## BP1C:

|                           |                       |
|---------------------------|-----------------------|
| $X_O = 208.44$ ns         | (223.38-14.94)        |
| $X_P = 52.6$ ns           | (BP1R+C166+BP1I+C157) |
| REFDLY = 261.04 ns        |                       |
| CABDLY = $X_C = 235.7$ ns | (C131)                |

Setup at the BIPM



BP0U-BP0R

## COMPUTATION OF BASELINE

Number of codes to fit baseline and biases = 68838  
 Computed code bias (P1/P2)/m = -26.570 -25.587  
 Computed baseline (X,Y,Z)/m = -5.393 -0.839 4.114  
 RMS of residuals /m = 0.677

Number of phase differences to fit baseline = 61680  
 A priori baseline (X,Y,Z)/m = -5.393 -0.839 4.114  
 14315 clock jitters computed out of 14559 intervals  
 AVE jitter /ps = -0.3 RMS jitter /ps = 37.1

Iter 1 Large residuals L1= 0  
 Iter 1 Large residuals L2= 0  
 Computed baseline L1 (X,Y,Z)/m = 0.190 0.062 0.343  
 RMS of residuals L1 /m = 0.004  
 Computed baseline L2 (X,Y,Z)/m = 0.219 0.058 0.364  
 RMS of residuals L2 /m = 0.004

Final baseline L1 (X,Y,Z)/m = -5.202 -0.777 4.457  
 Final baseline L2 (X,Y,Z)/m = -5.174 -0.781 4.479

## COMPUTATION OF CODE DIFFERENCES

Number of code differences = 69018

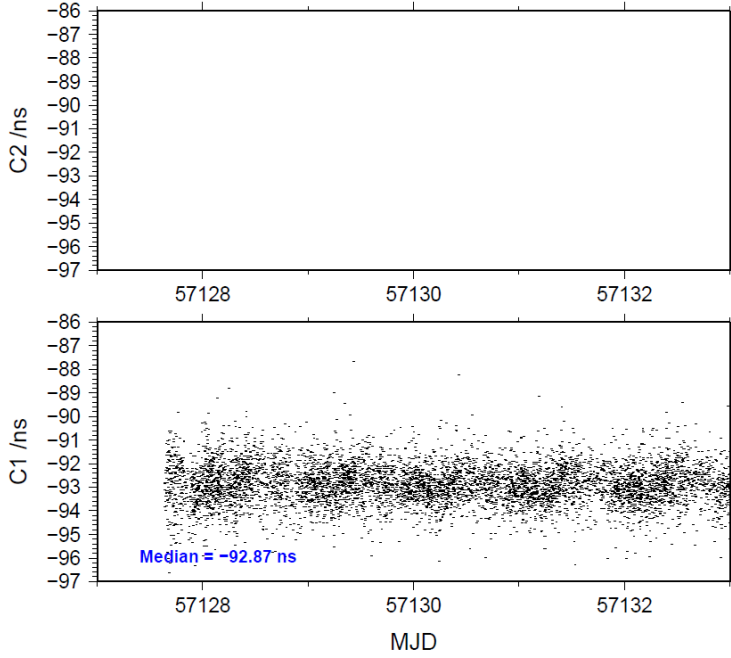
Global average of individual differences

Code #pts, ave/ns, rms/ns  
 C1: 68985 -92.852 1.511  
 C2: 0-NaN -NaN  
 P1: 68798 -89.618 2.314  
 P2: 68795 -86.424 2.586

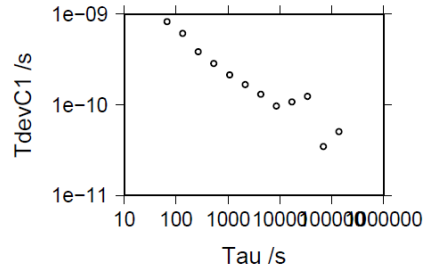
Number of 300s epochs in out file = 1546

Code #pts, median/ns, ave/ns, rms/ns  
 C1: 6911 -92.870 -92.864 0.844  
 C2: 0 0.000-NaN -NaN  
 P1: 6899 -89.687 -89.653 1.124  
 P2: 6899 -86.426 -86.412 1.441

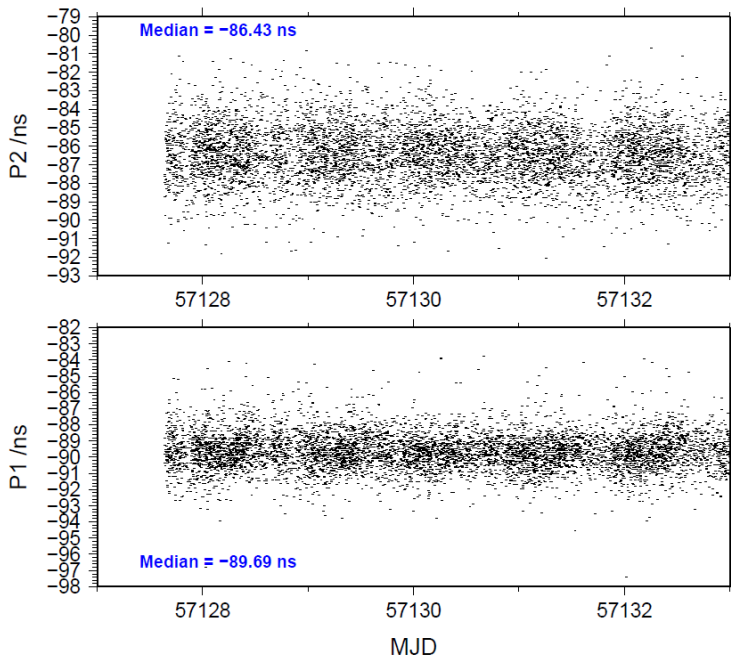
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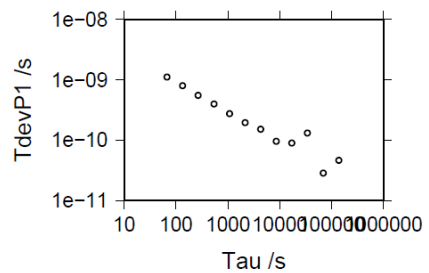
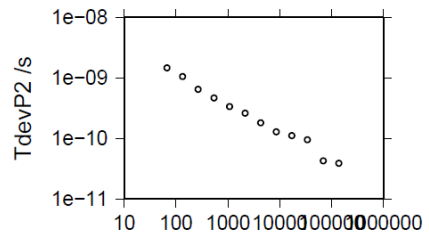
- 137373 s: C1= 50 ps
- 68687 s: C1= 35 ps
- 34343 s: C1= 124 ps
- 17172 s: C1= 107 ps
- 8586 s: C1= 97 ps
- 4293 s: C1= 131 ps
- 2146 s: C1= 168 ps
- 1073 s: C1= 214 ps
- 537 s: C1= 284 ps
- 268 s: C1= 383 ps
- 134 s: C1= 610 ps
- 67 s: C1= 823 ps



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- |                     |                     |
|---------------------|---------------------|
| 137612 s: P1= 47 ps | 137612 s: P2= 39 ps |
| 68806 s: P1= 29 ps  | 68806 s: P2= 43 ps  |
| 34403 s: P1= 132 ps | 34403 s: P2= 94 ps  |
| 17202 s: P1= 90 ps  | 17202 s: P2= 111 ps |
| 8601 s: P1= 97 ps   | 8601 s: P2= 128 ps  |
| 4300 s: P1= 152 ps  | 4300 s: P2= 180 ps  |
| 2150 s: P1= 196 ps  | 2150 s: P2= 262 ps  |
| 1075 s: P1= 275 ps  | 1075 s: P2= 337 ps  |
| 538 s: P1= 389 ps   | 538 s: P2= 468 ps   |
| 269 s: P1= 551 ps   | 269 s: P2= 650 ps   |
| 134 s: P1= 805 ps   | 134 s: P2= 1055 ps  |
| 67 s: P1= 1107 ps   | 67 s: P2= 1470 ps   |



BP1C-BP0R

## COMPUTATION OF BASELINE

Number of codes to fit baseline and biases = 104967  
 Computed code bias (P1/P2)/m = -17.624 -16.668  
 Computed baseline (X,Y,Z)/m = -4.478 -0.762 3.704  
 RMS of residuals /m = 0.656

Number of phase differences to fit baseline = 102830  
 A priori baseline (X,Y,Z)/m = -4.478 -0.762 3.704  
 17276 clock jitters computed out of 17276 intervals  
 AVE jitter /ps = 0.3 RMS jitter /ps = 6.2

Iter 1 Large residuals L1= 1  
 Iter 1 Large residuals L2= 3  
 Computed baseline L1 (X,Y,Z)/m = 0.019 0.048 0.110  
 RMS of residuals L1 /m = 0.005  
 Computed baseline L2 (X,Y,Z)/m = 0.022 0.050 0.105  
 RMS of residuals L2 /m = 0.005

Iter 2 Large residuals L1= 1  
 Iter 2 Large residuals L2= 3  
 Computed baseline L1 (X,Y,Z)/m = 0.019 0.048 0.110  
 RMS of residuals L1 /m = 0.005  
 Computed baseline L2 (X,Y,Z)/m = 0.022 0.050 0.105  
 RMS of residuals L2 /m = 0.005

Final baseline L1 (X,Y,Z)/m = -4.459 -0.713 3.814  
 Final baseline L2 (X,Y,Z)/m = -4.456 -0.712 3.808

## COMPUTATION OF CODE DIFFERENCES

Number of code differences = 108031

Global average of individual differences

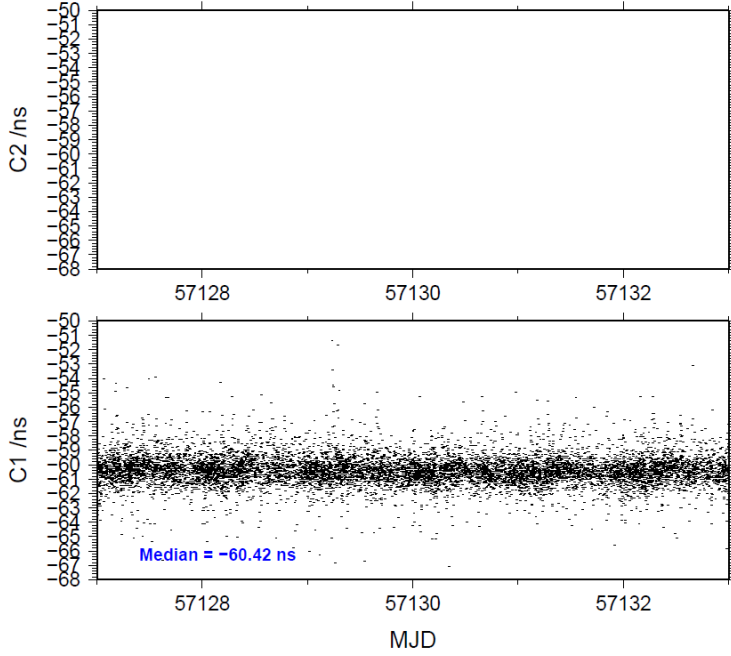
Code #pts, ave/ns, rms/ns  
 C1: 107375 -60.395 1.972  
 C2: 0-NaN -NaN  
 P1: 104920 -59.016 2.438  
 P2: 104834 -55.826 2.793

Number of 300s epochs in out file = 1728

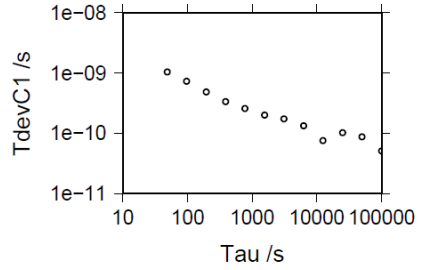
Code #pts, median/ns, ave/ns, rms/ns  
 C1: 10667 -60.425 -60.391 1.036  
 C2: 0 0.000-NaN -NaN  
 P1: 10463 -59.107 -59.041 1.263  
 P2: 10450 -55.834 -55.840 1.556



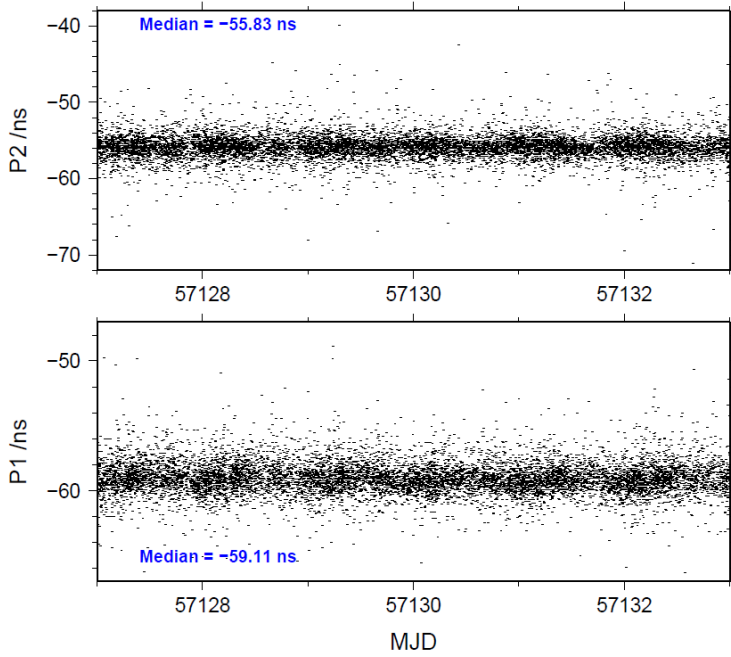
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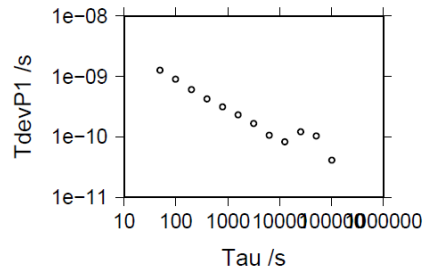
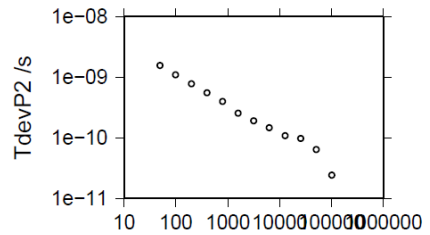
99481 s: C1= 51 ps  
 49741 s: C1= 88 ps  
 24870 s: C1= 103 ps  
 12435 s: C1= 75 ps  
 6218 s: C1= 133 ps  
 3109 s: C1= 173 ps  
 1554 s: C1= 202 ps  
 777 s: C1= 258 ps  
 389 s: C1= 333 ps  
 194 s: C1= 488 ps  
 97 s: C1= 727 ps  
 49 s: C1= 1039 ps



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101421 s: P1= 42 ps    101547 s: P2= 24 ps  
 50711 s: P1= 104 ps    50774 s: P2= 64 ps  
 25355 s: P1= 122 ps    25387 s: P2= 98 ps  
 12678 s: P1= 83 ps    12693 s: P2= 108 ps  
 6339 s: P1= 107 ps    6347 s: P2= 147 ps  
 3169 s: P1= 167 ps    3173 s: P2= 190 ps  
 1585 s: P1= 232 ps    1587 s: P2= 253 ps  
 792 s: P1= 313 ps    793 s: P2= 399 ps  
 396 s: P1= 426 ps    397 s: P2= 555 ps  
 198 s: P1= 609 ps    198 s: P2= 775 ps  
 99 s: P1= 895 ps    99 s: P2= 1090 ps  
 50 s: P1= 1270 ps    50 s: P2= 1561 ps



**4.5/ OP (15118)**Period

MJD 57140 to 56147

Delays

## BP0U:

$$\text{REFDLY} = X_P = -26.52 + 52.6 = 26.08 \text{ ns} \quad (-26.52 + \text{BP1R} + \text{C166} + \text{BP1I} + \text{C153})$$

$$\text{CABDLY} = X_C = 182.0 \text{ ns} \quad (\text{C134})$$

## BP1C:

$$X_O = 196.76 \text{ ns}$$

$$X_P = -26.52 + 52.6 = 26.08 \text{ ns} \quad (-26.52 + \text{BP1R} + \text{C166} + \text{BP1I} + \text{C157})$$

$$\text{REFDLY} = 222.84 \text{ ns}$$

$$\text{CABDLY} = X_C = 235.7 \text{ ns} \quad (\text{C131})$$

## OPMT:

$$\text{REFDLY} = 100.12 \text{ ns}$$

$$\text{CABDLY} = 156.5 \text{ ns}$$

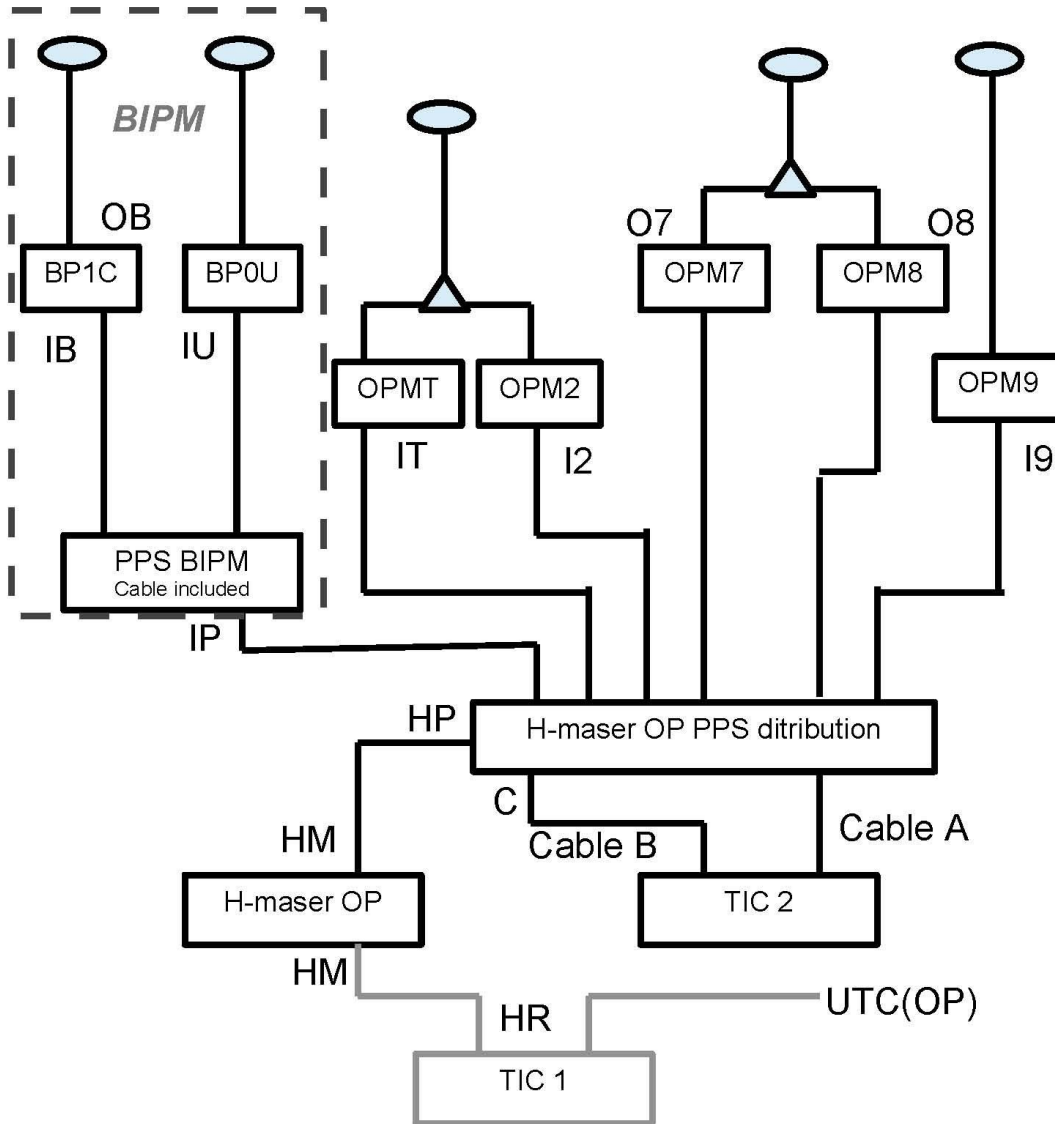
## OPM7:

$$\text{REFDLY} = 128.12 \text{ ns}$$

## OPM8:

$$\text{REFDLY} = 124.63 \text{ ns}$$

Setup at the OP



HM = reference H-Maser  
 IB = 1 PPS IN BP1C  
 IU = 1 PPS IN BP1C  
 OB = 1 PPS OUT BP1C  
 IT = 1 PPS IN OPMT  
 I2 = 1 PPS IN OPM2  
 Cable A = arbitrary fixed cable  
 C = mobile measurement point

IP = 1 PPS IN BIPM Station + cable  
 O7 = 1 PPS OUT OPM7  
 O8 = 1 PPS OUT OPM8  
 I9 = 1 PPS IN OPM9  
 HR = 1 PPS H-maser -- UTC(OP)  
 HP = Distributed 1 PPS H-maser  
 Cable B = arbitrary mobile cable

BP0U-OPMT

## COMPUTATION OF BASELINE

Number of codes to fit baseline and biases = 98144  
 Computed code bias (P1/P2)/m = -103.710 -105.462  
 Computed baseline (X,Y,Z)/m = 0.047 3.988 -2.268  
 RMS of residuals /m = 0.607

Number of phase differences to fit baseline = 92713  
 A priori baseline (X,Y,Z)/m = 0.047 3.988 -2.268  
 18744 clock jitters computed out of 18806 intervals  
 AVE jitter /ps = 0.2 RMS jitter /ps = 32.5

Iter 1 Large residuals L1= 0  
 Iter 1 Large residuals L2= 0  
 Computed baseline L1 (X,Y,Z)/m = 0.177 0.032 0.173  
 RMS of residuals L1 /m = 0.003  
 Computed baseline L2 (X,Y,Z)/m = 0.188 0.034 0.180  
 RMS of residuals L2 /m = 0.003

Final baseline L1 (X,Y,Z)/m = 0.224 4.020 -2.095  
 Final baseline L2 (X,Y,Z)/m = 0.235 4.022 -2.088

## COMPUTATION OF CODE DIFFERENCES

Number of code differences = 98167

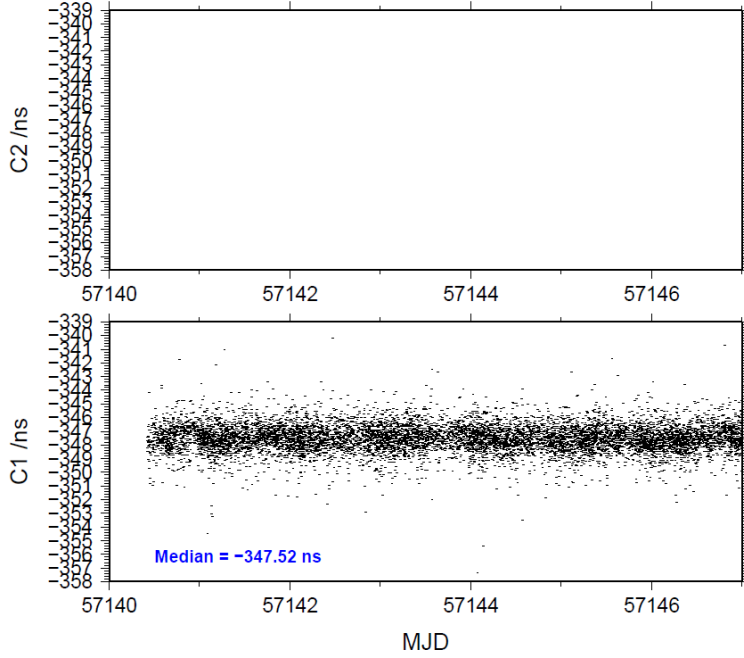
Global average of individual differences

Code #pts, ave/ns, rms/ns  
 C1: 98131 -347.494 2.116  
 C2: 0-NaN -NaN  
 P1: 98114 -346.539 2.031  
 P2: 98121 -352.417 2.284

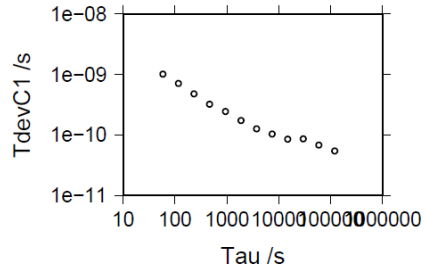
Number of 300s epochs in out file = 1894

Code #pts, median/ns, ave/ns, rms/ns  
 C1: 9732 -347.520 -347.516 1.002  
 C2: 0 0.000-NaN -NaN  
 P1: 9732 -346.597 -346.559 1.058  
 P2: 9732 -352.466 -352.420 1.274

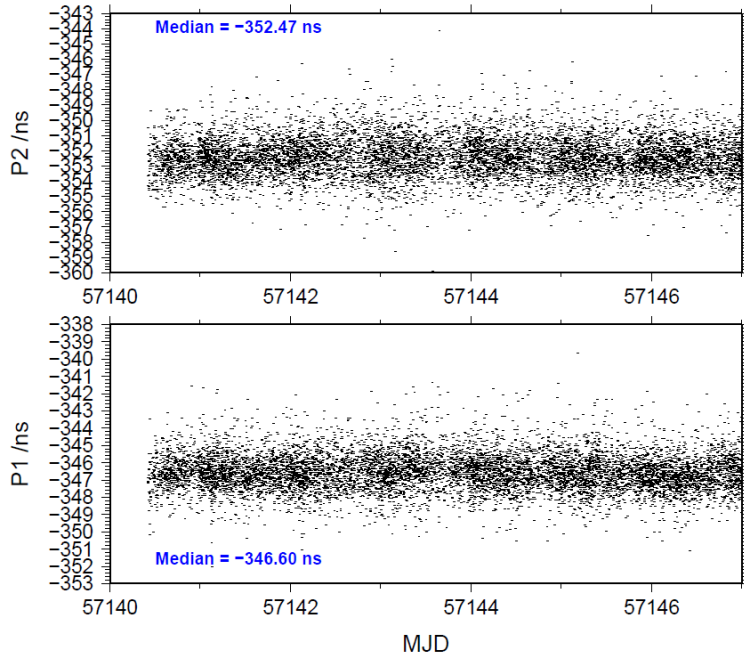
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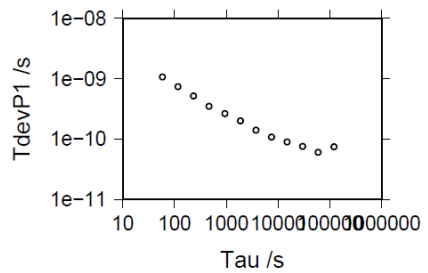
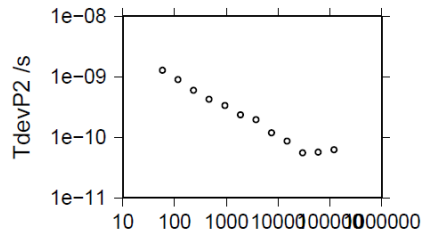
119521 s: C1= 54 ps  
 59761 s: C1= 69 ps  
 29880 s: C1= 86 ps  
 14940 s: C1= 85 ps  
 7470 s: C1= 105 ps  
 3735 s: C1= 126 ps  
 1868 s: C1= 175 ps  
 934 s: C1= 243 ps  
 467 s: C1= 321 ps  
 233 s: C1= 481 ps  
 117 s: C1= 707 ps  
 58 s: C1= 1019 ps



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119521 s: P1= 75 ps    119521 s: P2= 63 ps  
 59761 s: P1= 60 ps    59761 s: P2= 57 ps  
 29880 s: P1= 75 ps    29880 s: P2= 55 ps  
 14940 s: P1= 90 ps    14940 s: P2= 86 ps  
 7470 s: P1= 108 ps    7470 s: P2= 118 ps  
 3735 s: P1= 140 ps    3735 s: P2= 195 ps  
 1868 s: P1= 201 ps    1868 s: P2= 235 ps  
 934 s: P1= 266 ps    934 s: P2= 337 ps  
 467 s: P1= 348 ps    467 s: P2= 426 ps  
 233 s: P1= 519 ps    233 s: P2= 600 ps  
 117 s: P1= 735 ps    117 s: P2= 901 ps  
 58 s: P1= 1062 ps    58 s: P2= 1285 ps



BP0U-OPM7

## COMPUTATION OF BASELINE

Number of codes to fit baseline and biases = 98054  
 Computed code bias (P1/P2)/m = -36.424 -35.705  
 Computed baseline (X,Y,Z)/m = 5.110 6.075 -4.477  
 RMS of residuals /m = 0.534

Number of phase differences to fit baseline = 92647  
 A priori baseline (X,Y,Z)/m = 5.110 6.075 -4.477  
 18753 clock jitters computed out of 18817 intervals  
 AVE jitter /ps = -0.8 RMS jitter /ps = 32.6

Iter 1 Large residuals L1= 2  
 Iter 1 Large residuals L2= 2  
 Computed baseline L1 (X,Y,Z)/m = 0.213 -0.027 0.372  
 RMS of residuals L1 /m = 0.004  
 Computed baseline L2 (X,Y,Z)/m = 0.233 -0.028 0.381  
 RMS of residuals L2 /m = 0.003

Iter 2 Large residuals L1= 2  
 Iter 2 Large residuals L2= 2  
 Computed baseline L1 (X,Y,Z)/m = 0.213 -0.027 0.372  
 RMS of residuals L1 /m = 0.004  
 Computed baseline L2 (X,Y,Z)/m = 0.233 -0.028 0.381  
 RMS of residuals L2 /m = 0.003

Final baseline L1 (X,Y,Z)/m = 5.323 6.048 -4.105  
 Final baseline L2 (X,Y,Z)/m = 5.343 6.047 -4.096

## COMPUTATION OF CODE DIFFERENCES

Number of code differences = 98057

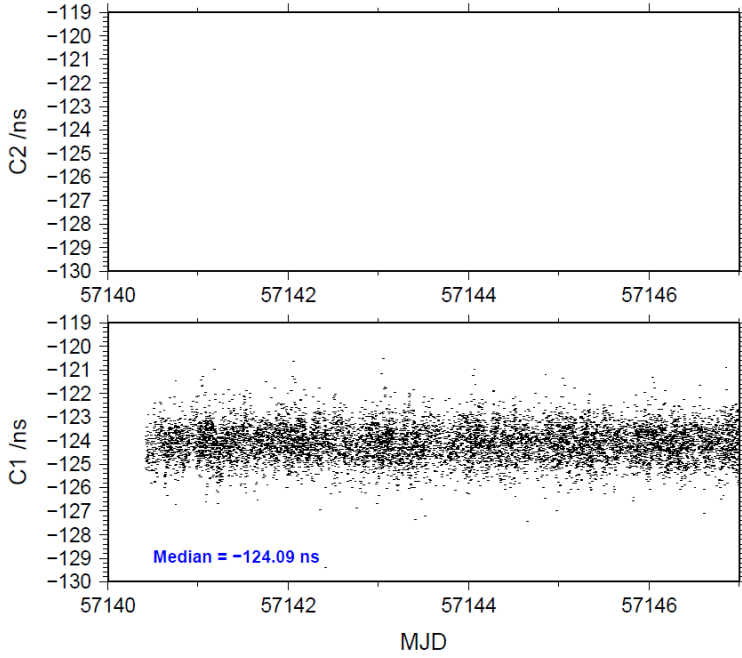
Global average of individual differences

Code #pts, ave/ns, rms/ns  
 C1: 98027 -124.102 1.188  
 C2: 0-NaN -NaN  
 P1: 98024 -122.618 1.621  
 P2: 98023 -120.279 2.038

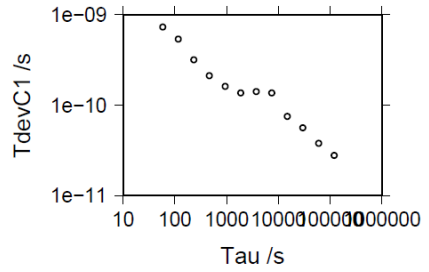
Number of 300s epochs in out file = 1894

Code #pts, median/ns, ave/ns, rms/ns  
 C1: 9720 -124.093 -124.099 0.729  
 C2: 0 0.000-NaN -NaN  
 P1: 9720 -122.647 -122.629 0.920  
 P2: 9720 -120.278 -120.270 1.280

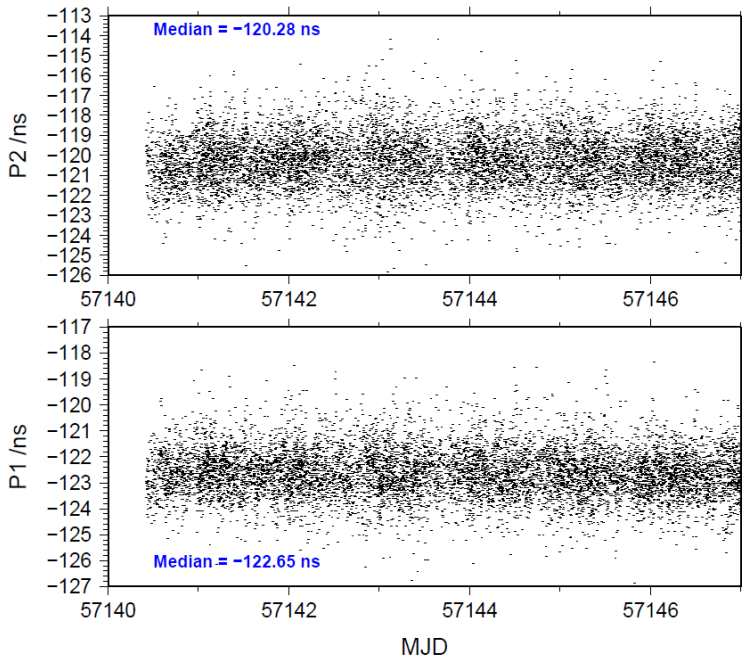
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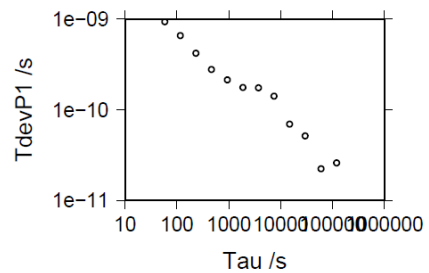
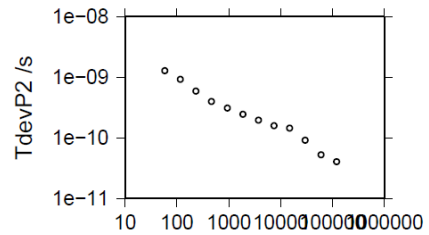
119669 s: C1= 28 ps  
59834 s: C1= 38 ps  
29917 s: C1= 56 ps  
14959 s: C1= 75 ps  
7479 s: C1= 136 ps  
3740 s: C1= 141 ps  
1870 s: C1= 136 ps  
935 s: C1= 161 ps  
467 s: C1= 212 ps  
234 s: C1= 316 ps  
117 s: C1= 536 ps  
58 s: C1= 731 ps



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119669 s: P1= 26 ps    119669 s: P2= 40 ps  
59834 s: P1= 22 ps    59834 s: P2= 53 ps  
29917 s: P1= 51 ps    29917 s: P2= 91 ps  
14959 s: P1= 69 ps    14959 s: P2= 144 ps  
7479 s: P1= 141 ps    7479 s: P2= 158 ps  
3740 s: P1= 175 ps    3740 s: P2= 196 ps  
1870 s: P1= 176 ps    1870 s: P2= 244 ps  
935 s: P1= 214 ps    935 s: P2= 309 ps  
467 s: P1= 279 ps    467 s: P2= 396 ps  
234 s: P1= 418 ps    234 s: P2= 592 ps  
117 s: P1= 658 ps    117 s: P2= 920 ps  
58 s: P1= 936 ps    58 s: P2= 1288 ps



BP0U-OPM8

## COMPUTATION OF BASELINE

Number of codes to fit baseline and biases = 98351  
 Computed code bias (P1/P2)/m = -37.492 -36.778  
 Computed baseline (X,Y,Z)/m = 5.108 6.075 -4.478  
 RMS of residuals /m = 0.534

Number of phase differences to fit baseline = 92917  
 A priori baseline (X,Y,Z)/m = 5.108 6.075 -4.478  
 18757 clock jitters computed out of 18810 intervals  
 AVE jitter /ps = -0.8 RMS jitter /ps = 32.6

Iter 1 Large residuals L1= 1  
 Iter 1 Large residuals L2= 1  
 Computed baseline L1 (X,Y,Z)/m = 0.211 -0.027 0.369  
 RMS of residuals L1 /m = 0.004  
 Computed baseline L2 (X,Y,Z)/m = 0.231 -0.029 0.378  
 RMS of residuals L2 /m = 0.003

Iter 2 Large residuals L1= 1  
 Iter 2 Large residuals L2= 1  
 Computed baseline L1 (X,Y,Z)/m = 0.211 -0.027 0.369  
 RMS of residuals L1 /m = 0.004  
 Computed baseline L2 (X,Y,Z)/m = 0.231 -0.029 0.378  
 RMS of residuals L2 /m = 0.003

Final baseline L1 (X,Y,Z)/m = 5.320 6.048 -4.109  
 Final baseline L2 (X,Y,Z)/m = 5.339 6.046 -4.100

## COMPUTATION OF CODE DIFFERENCES

Number of code differences = 98354

Global average of individual differences

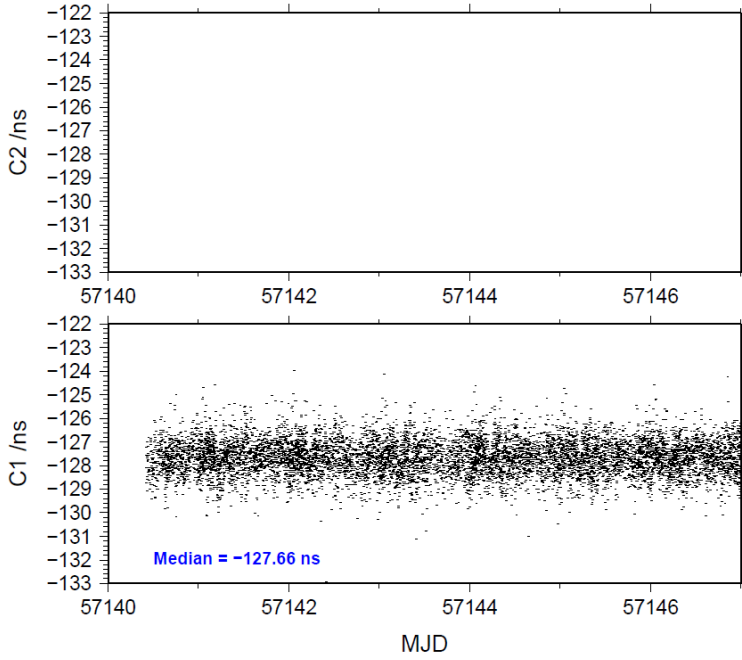
Code #pts, ave/ns, rms/ns  
 C1: 98324 -127.658 1.190  
 C2: 0-NaN -NaN  
 P1: 98321 -126.172 1.622  
 P2: 98320 -123.846 2.039

Number of 300s epochs in out file = 1894

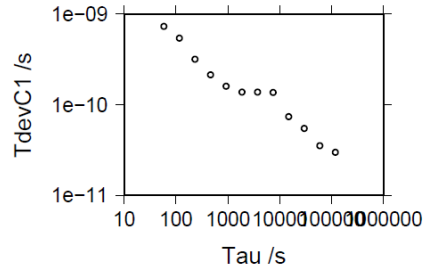
Code #pts, median/ns, ave/ns, rms/ns  
 C1: 9750 -127.656 -127.656 0.730  
 C2: 0 0.000-NaN -NaN  
 P1: 9750 -126.199 -126.184 0.919  
 P2: 9750 -123.845 -123.838 1.280



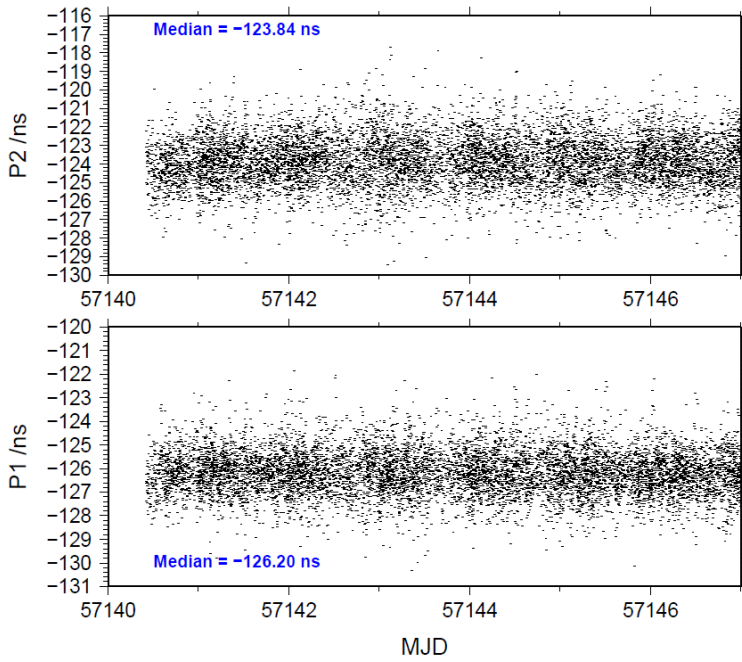
05/20/15 bp0uopm815118\_7



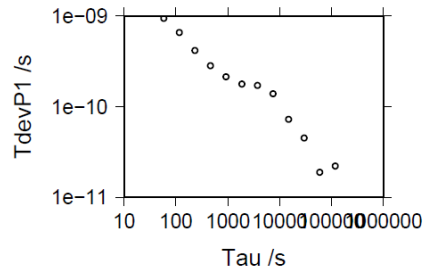
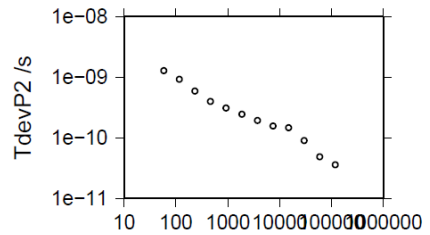
119300 s: C1= 30 ps  
 59650 s: C1= 35 ps  
 29825 s: C1= 55 ps  
 14913 s: C1= 74 ps  
 7456 s: C1= 136 ps  
 3728 s: C1= 138 ps  
 1864 s: C1= 137 ps  
 932 s: C1= 189 ps  
 466 s: C1= 214 ps  
 233 s: C1= 318 ps  
 116 s: C1= 539 ps  
 58 s: C1= 730 ps



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119300 s: P1= 22 ps    119300 s: P2= 36 ps  
 59650 s: P1= 19 ps    59650 s: P2= 49 ps  
 29825 s: P1= 45 ps    29825 s: P2= 90 ps  
 14913 s: P1= 73 ps    14913 s: P2= 147 ps  
 7456 s: P1= 139 ps    7456 s: P2= 157 ps  
 3728 s: P1= 171 ps    3728 s: P2= 194 ps  
 1864 s: P1= 177 ps    1864 s: P2= 245 ps  
 932 s: P1= 214 ps    932 s: P2= 310 ps  
 466 s: P1= 282 ps    466 s: P2= 397 ps  
 233 s: P1= 416 ps    233 s: P2= 593 ps  
 116 s: P1= 656 ps    116 s: P2= 922 ps  
 58 s: P1= 937 ps    58 s: P2= 1286 ps



BP1C-OPMT

## COMPUTATION OF BASELINE

Number of codes to fit baseline and biases = 138140  
 Computed code bias (P1/P2)/m = -91.246 -93.089  
 Computed baseline (X,Y,Z)/m = 0.421 3.250 -2.255  
 RMS of residuals /m = 0.605

Number of phase differences to fit baseline = 137218  
 A priori baseline (X,Y,Z)/m = 0.421 3.250 -2.255  
 18922 clock jitters computed out of 18922 intervals  
 AVE jitter /ps = 0.1 RMS jitter /ps = 4.4

Iter 1 Large residuals L1= 0  
 Iter 1 Large residuals L2= 0  
 Computed baseline L1 (X,Y,Z)/m = 0.076 0.031 0.023  
 RMS of residuals L1 /m = 0.003  
 Computed baseline L2 (X,Y,Z)/m = 0.073 0.027 0.020  
 RMS of residuals L2 /m = 0.004

Final baseline L1 (X,Y,Z)/m = 0.498 3.282 -2.233  
 Final baseline L2 (X,Y,Z)/m = 0.495 3.278 -2.236

## COMPUTATION OF CODE DIFFERENCES

Number of code differences = 139586

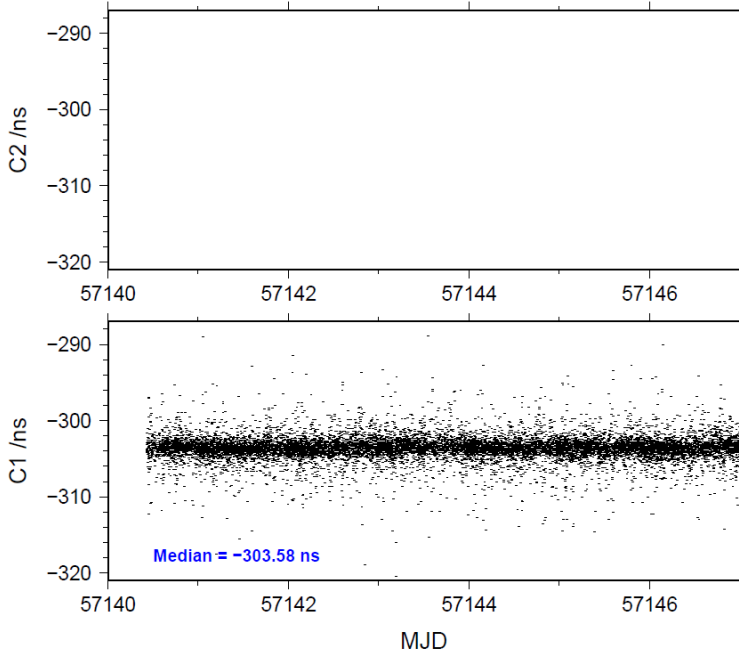
Global average of individual differences

Code #pts, ave/ns, rms/ns  
 C1: 138712 -303.569 3.418  
 C2: 0-NaN -NaN  
 P1: 138148 -304.509 2.580  
 P2: 138248 -310.650 2.666

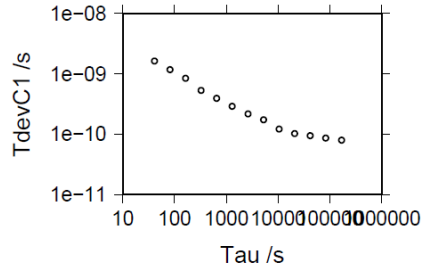
Number of 300s epochs in out file = 1893

Code #pts, median/ns, ave/ns, rms/ns  
 C1: 13897 -303.581 -303.613 1.639  
 C2: 0 0.000-NaN -NaN  
 P1: 13798 -304.581 -304.542 1.301  
 P2: 13806 -310.674 -310.673 1.412

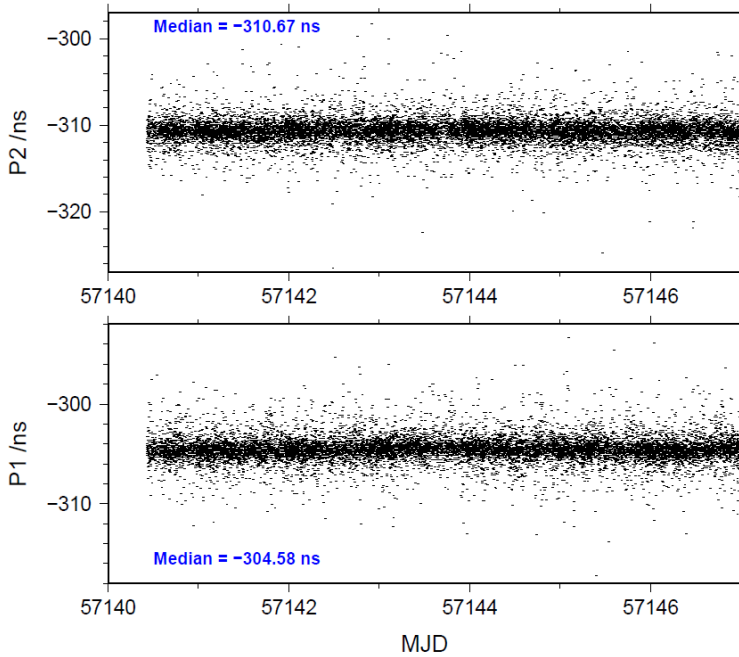
05/06/15 bp1copmt15118\_7



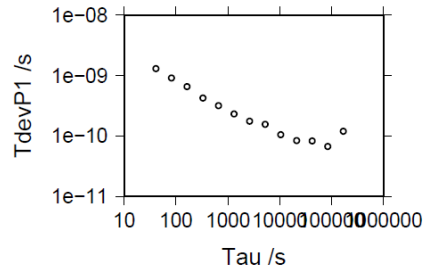
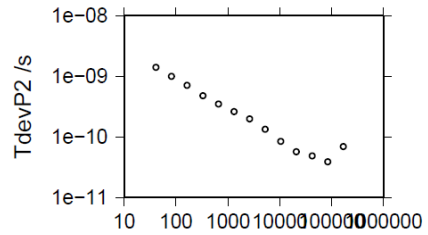
- 167306 s: C1= 80 ps
- 83653 s: C1= 87 ps
- 41827 s: C1= 94 ps
- 20913 s: C1= 103 ps
- 10457 s: C1= 122 ps
- 5228 s: C1= 173 ps
- 2614 s: C1= 219 ps
- 1307 s: C1= 290 ps
- 654 s: C1= 395 ps
- 327 s: C1= 535 ps
- 163 s: C1= 841 ps
- 82 s: C1= 1175 ps
- 41 s: C1= 1618 ps



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- 168507 s: P1= 120 ps
- 84253 s: P1= 68 ps
- 42127 s: P1= 83 ps
- 21063 s: P1= 84 ps
- 10532 s: P1= 106 ps
- 5266 s: P1= 156 ps
- 2633 s: P1= 177 ps
- 1316 s: P1= 233 ps
- 658 s: P1= 320 ps
- 329 s: P1= 427 ps
- 165 s: P1= 655 ps
- 82 s: P1= 916 ps
- 41 s: P1= 1294 ps
- 168409 s: P2= 69 ps
- 84205 s: P2= 39 ps
- 42102 s: P2= 49 ps
- 21051 s: P2= 56 ps
- 10526 s: P2= 85 ps
- 5263 s: P2= 134 ps
- 2631 s: P2= 197 ps
- 1316 s: P2= 261 ps
- 658 s: P2= 349 ps
- 329 s: P2= 478 ps
- 164 s: P2= 712 ps
- 82 s: P2= 1001 ps
- 41 s: P2= 1405 ps



BP1C-OPM7

## COMPUTATION OF BASELINE

Number of codes to fit baseline and biases = 148649  
 Computed code bias (P1/P2)/m = -23.902 -23.256  
 Computed baseline (X,Y,Z)/m = 5.201 4.935 -4.290  
 RMS of residuals /m = 0.488

Number of phase differences to fit baseline = 147554  
 A priori baseline (X,Y,Z)/m = 5.201 4.935 -4.290  
 18922 clock jitters computed out of 18922 intervals  
 AVE jitter /ps = -0.4 RMS jitter /ps = 5.0

Iter 1 Large residuals L1= 0  
 Iter 1 Large residuals L2= 0  
 Computed baseline L1 (X,Y,Z)/m = 0.204 0.024 0.328  
 RMS of residuals L1 /m = 0.004  
 Computed baseline L2 (X,Y,Z)/m = 0.206 0.021 0.327  
 RMS of residuals L2 /m = 0.005

Final baseline L1 (X,Y,Z)/m = 5.405 4.959 -3.962  
 Final baseline L2 (X,Y,Z)/m = 5.407 4.956 -3.963

## COMPUTATION OF CODE DIFFERENCES

Number of code differences = 149301

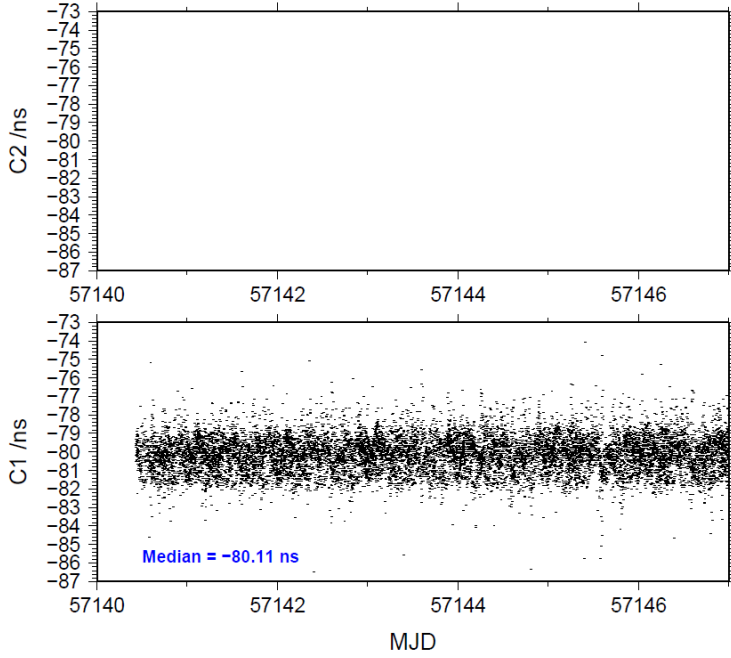
Global average of individual differences

Code #pts, ave/ns, rms/ns  
 C1: 149163 -80.131 1.487  
 C2: 0-NaN -NaN  
 P1: 148603 -80.619 1.597  
 P2: 148584 -78.466 1.927

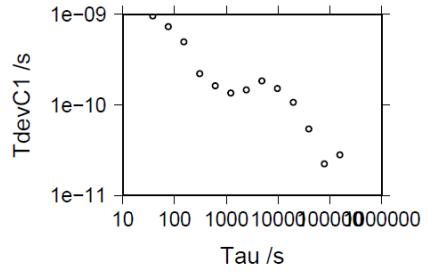
Number of 300s epochs in out file = 1893

Code #pts, median/ns, ave/ns, rms/ns  
 C1: 14900 -80.112 -80.140 0.971  
 C2: 0 0.000-NaN -NaN  
 P1: 14840 -80.609 -80.630 1.063  
 P2: 14837 -78.505 -78.469 1.373

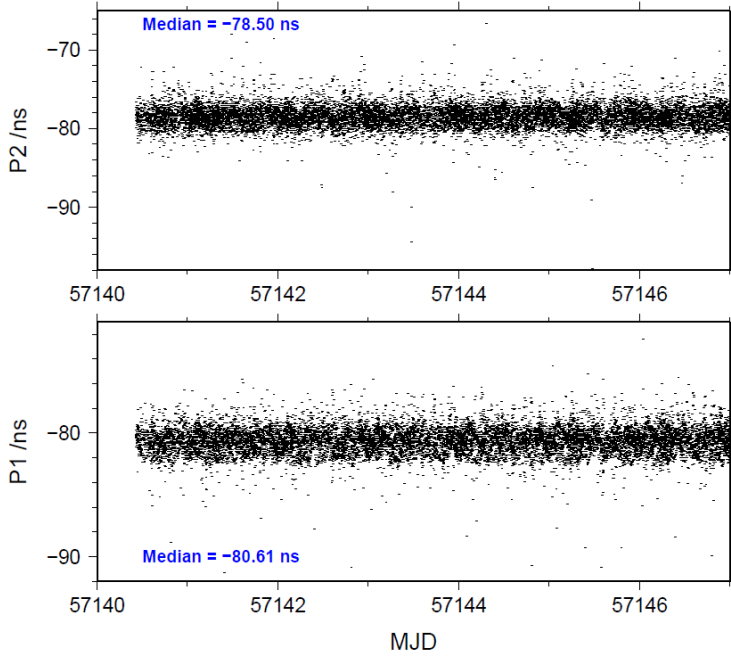
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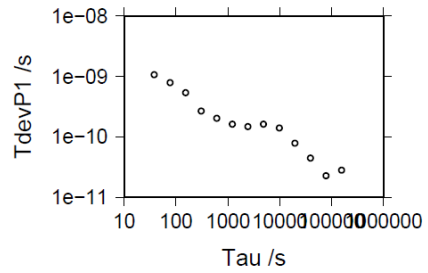
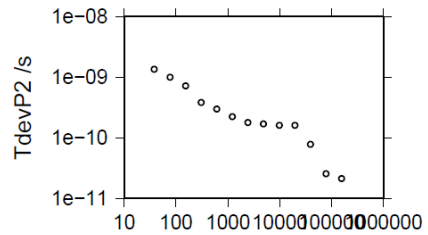
156043 s: C1= 28 ps  
78022 s: C1= 22 ps  
39011 s: C1= 54 ps  
19505 s: C1= 107 ps  
9753 s: C1= 152 ps  
4876 s: C1= 184 ps  
2438 s: C1= 146 ps  
1219 s: C1= 135 ps  
610 s: C1= 162 ps  
305 s: C1= 221 ps  
152 s: C1= 494 ps  
76 s: C1= 728 ps  
38 s: C1= 960 ps



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156674 s: P1= 28 ps    156706 s: P2= 21 ps  
78337 s: P1= 23 ps    78353 s: P2= 25 ps  
39169 s: P1= 45 ps    39176 s: P2= 78 ps  
19584 s: P1= 79 ps    19588 s: P2= 160 ps  
9792 s: P1= 140 ps    9794 s: P2= 162 ps  
4896 s: P1= 164 ps    4897 s: P2= 168 ps  
2448 s: P1= 148 ps    2449 s: P2= 177 ps  
1224 s: P1= 163 ps    1224 s: P2= 223 ps  
612 s: P1= 203 ps    612 s: P2= 296 ps  
306 s: P1= 268 ps    306 s: P2= 381 ps  
153 s: P1= 539 ps    153 s: P2= 719 ps  
76 s: P1= 794 ps    77 s: P2= 999 ps  
38 s: P1= 1063 ps    38 s: P2= 1360 ps



BP1C-OPM8

## COMPUTATION OF BASELINE

Number of codes to fit baseline and biases = 148958  
 Computed code bias (P1/P2)/m = -24.970 -24.329  
 Computed baseline (X,Y,Z)/m = 5.198 4.936 -4.291  
 RMS of residuals /m = 0.488

Number of phase differences to fit baseline = 147872  
 A priori baseline (X,Y,Z)/m = 5.198 4.936 -4.291  
 18922 clock jitters computed out of 18922 intervals  
 AVE jitter /ps = -0.5 RMS jitter /ps = 5.0

Iter 1 Large residuals L1= 0  
 Iter 1 Large residuals L2= 0  
 Computed baseline L1 (X,Y,Z)/m = 0.202 0.024 0.326  
 RMS of residuals L1 /m = 0.004  
 Computed baseline L2 (X,Y,Z)/m = 0.203 0.022 0.325  
 RMS of residuals L2 /m = 0.005

Final baseline L1 (X,Y,Z)/m = 5.400 4.960 -3.965  
 Final baseline L2 (X,Y,Z)/m = 5.401 4.958 -3.967

## COMPUTATION OF CODE DIFFERENCES

Number of code differences = 149601

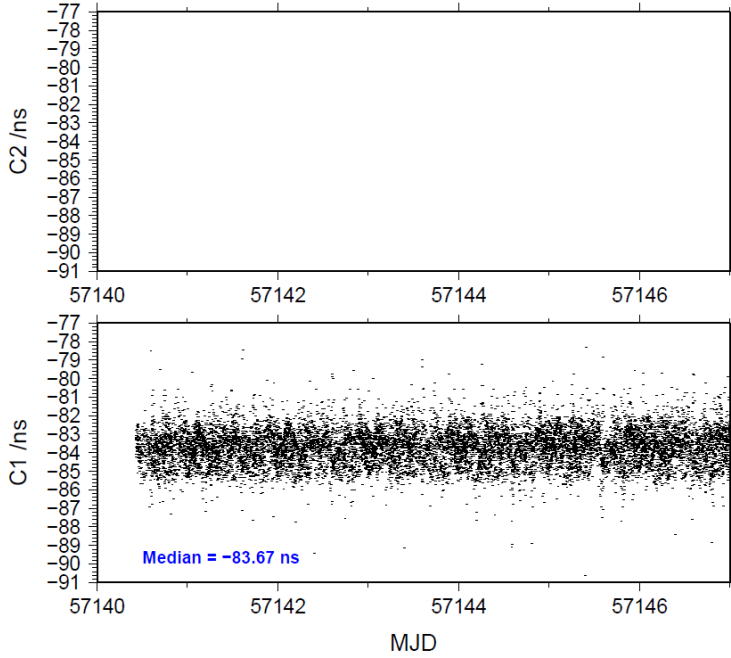
Global average of individual differences

Code #pts, ave/ns, rms/ns  
 C1: 149463 -83.689 1.490  
 C2: 0-NaN -NaN  
 P1: 148912 -84.176 1.599  
 P2: 148894 -82.036 1.929

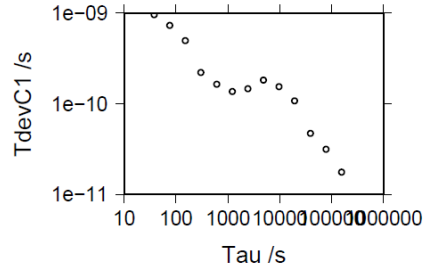
Number of 300s epochs in out file = 1893

Code #pts, median/ns, ave/ns, rms/ns  
 C1: 14932 -83.673 -83.696 0.970  
 C2: 0 0.000-NaN -NaN  
 P1: 14873 -84.164 -84.185 1.066  
 P2: 14870 -82.069 -82.040 1.373

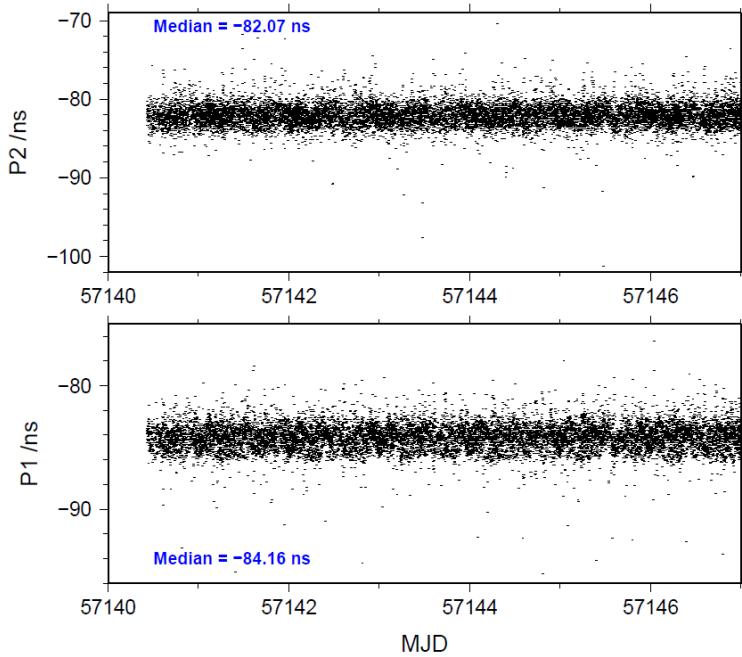
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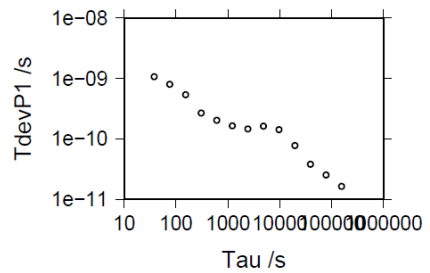
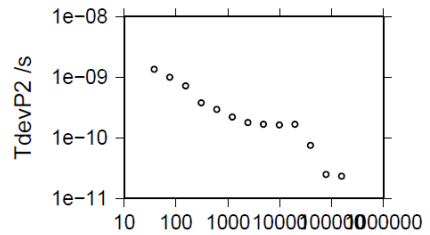
- 155709 s: C1= 18 ps
- 77854 s: C1= 32 ps
- 38927 s: C1= 47 ps
- 19464 s: C1= 107 ps
- 9732 s: C1= 155 ps
- 4866 s: C1= 183 ps
- 2433 s: C1= 147 ps
- 1216 s: C1= 137 ps
- 608 s: C1= 164 ps
- 304 s: C1= 222 ps
- 152 s: C1= 497 ps
- 76 s: C1= 730 ps
- 38 s: C1= 953 ps



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- 156327 s: P1= 16 ps
- 78163 s: P1= 25 ps
- 39082 s: P1= 38 ps
- 19541 s: P1= 78 ps
- 9770 s: P1= 143 ps
- 4885 s: P1= 162 ps
- 2443 s: P1= 146 ps
- 1221 s: P1= 165 ps
- 611 s: P1= 204 ps
- 305 s: P1= 267 ps
- 153 s: P1= 541 ps
- 76 s: P1= 800 ps
- 38 s: P1= 1062 ps
- 156358 s: P2= 23 ps
- 78179 s: P2= 25 ps
- 39090 s: P2= 75 ps
- 19545 s: P2= 168 ps
- 9772 s: P2= 163 ps
- 4886 s: P2= 167 ps
- 2443 s: P2= 178 ps
- 1222 s: P2= 220 ps
- 611 s: P2= 294 ps
- 305 s: P2= 380 ps
- 153 s: P2= 721 ps
- 76 s: P2= 1000 ps
- 38 s: P2= 1357 ps



**4.6/ OP (15126)**Period

MJD 57148 to 57155

Delays

## BP0U:

$$\text{REFDLY} = X_P = 272.97 + 52.6 = 325.57 \text{ ns} \quad (272.97 + \text{BP1R} + \text{C166} + \text{BP1I} + \text{C153})$$

$$\text{CABDLY} = X_C = 182.0 \text{ ns} \quad (\text{C134})$$

## BP1C:

$$X_O = 193.33 \text{ ns}$$

$$X_P = 272.97 + 52.6 = 325.57 \text{ ns} \quad (272.97 + \text{BP1R} + \text{C166} + \text{BP1I} + \text{C157})$$

$$\text{REFDLY} = 518.9 \text{ ns}$$

$$\text{CABDLY} = X_C = 235.7 \text{ ns} \quad (\text{C131})$$

## OPMT:

$$\text{REFDLY} = 100.12 \text{ ns}$$

$$\text{CABDLY} = 156.5 \text{ ns}$$

## OPM7:

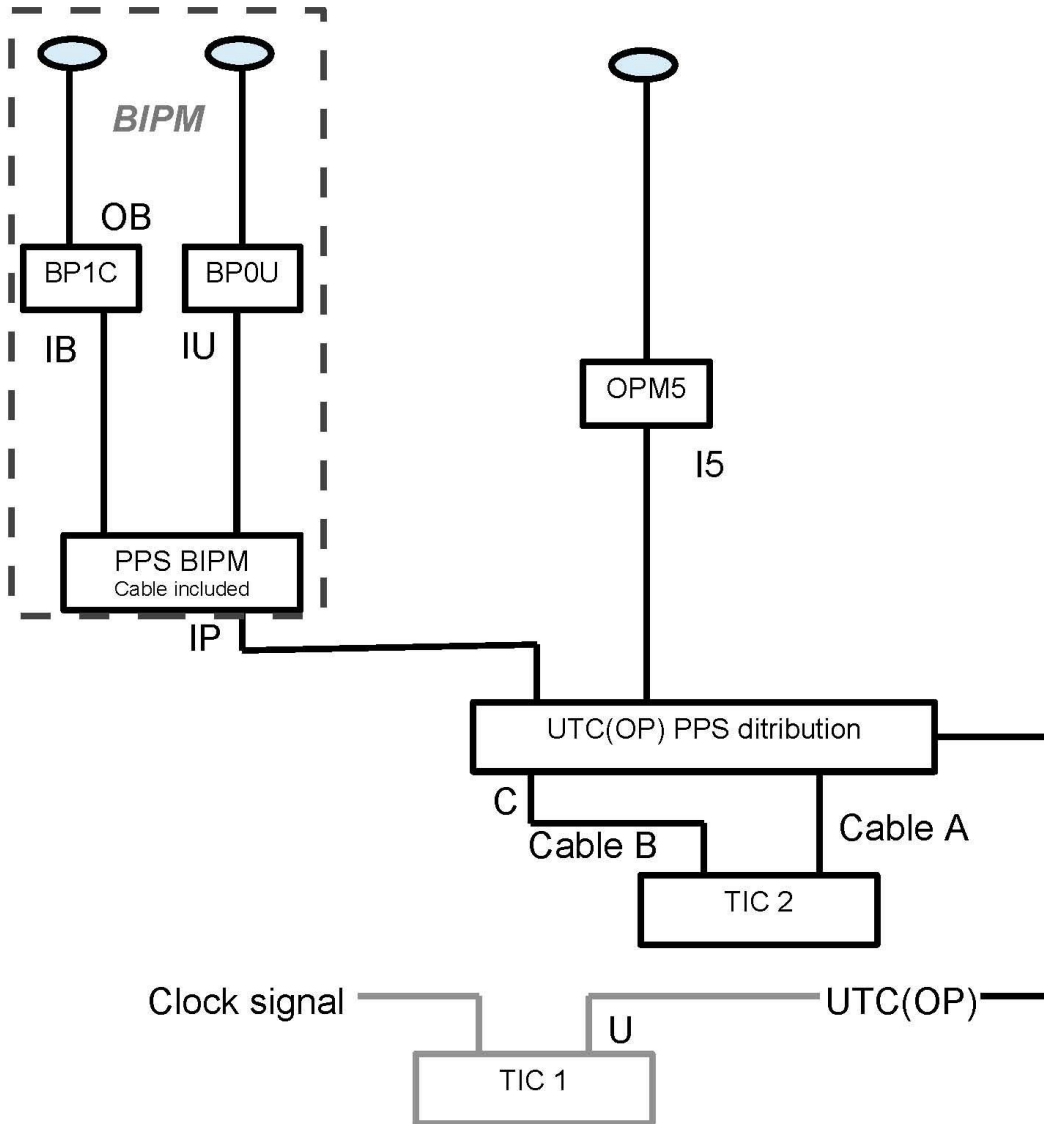
$$\text{REFDLY} = 128.12 \text{ ns}$$

## OPM8:

$$\text{REFDLY} = 124.63 \text{ ns}$$



Setup at the OP



- |                                 |                                    |
|---------------------------------|------------------------------------|
| HM = reference H-Maser          | IP = 1 PPS IN BIPM Station + cable |
| IB = 1 PPS IN BP1C              | IU = 1 PPS IN BP1C                 |
| OB = 1 PPS OUT BP1C             | I5 = 1 PPS IN OPM5                 |
| Cable A = arbitrary fixed cable | Cable B = arbitrary mobile cable   |
| C = mobile measurement point    | U = UTC(OP) reference point        |

BP0U-OPMT

## COMPUTATION OF BASELINE

Number of codes to fit baseline and biases = 92375  
 Computed code bias (P1/P2)/m = -193.778 -195.739  
 Computed baseline (X,Y,Z)/m = -0.001 3.982 -2.274  
 RMS of residuals /m = 0.607

Number of phase differences to fit baseline = 54216  
 A priori baseline (X,Y,Z)/m = -0.001 3.982 -2.274  
 10479 clock jitters computed out of 11026 intervals  
 AVE jitter /ps = 0.8 RMS jitter /ps = 63.2

Iter 1 Large residuals L1= 583  
 Iter 1 Large residuals L2= 583  
 Computed baseline L1 (X,Y,Z)/m = 0.219 0.036 0.174  
 RMS of residuals L1 /m = 0.004  
 Computed baseline L2 (X,Y,Z)/m = 0.228 0.042 0.181  
 RMS of residuals L2 /m = 0.004

Iter 2 Large residuals L1= 583  
 Iter 2 Large residuals L2= 583  
 Computed baseline L1 (X,Y,Z)/m = 0.220 0.036 0.175  
 RMS of residuals L1 /m = 0.004  
 Computed baseline L2 (X,Y,Z)/m = 0.228 0.042 0.181  
 RMS of residuals L2 /m = 0.004

Final baseline L1 (X,Y,Z)/m = 0.219 4.018 -2.099  
 Final baseline L2 (X,Y,Z)/m = 0.227 4.024 -2.092

## COMPUTATION OF CODE DIFFERENCES

Number of code differences = 92389

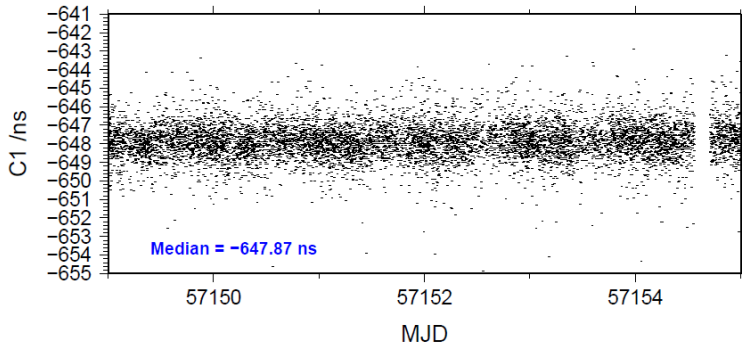
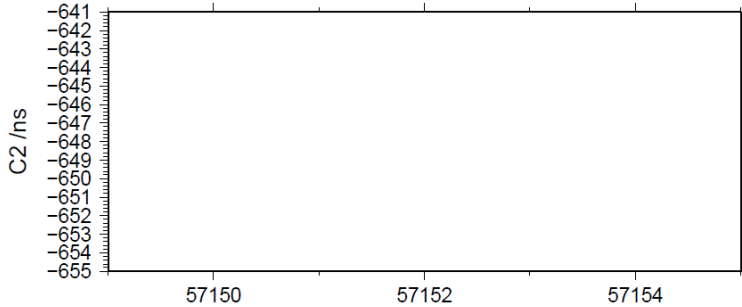
Global average of individual differences

Code #pts, ave/ns, rms/ns  
 C1: 92309 -647.847 2.099  
 C2: 0-NaN -NaN  
 P1: 92307 -647.054 1.965  
 P2: 90721 -652.785 2.165

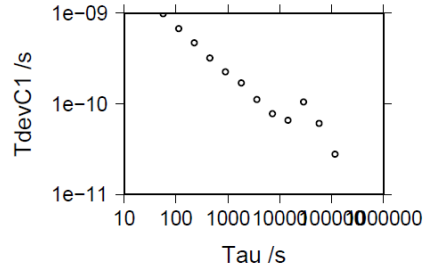
Number of 300s epochs in out file = 1686

Code #pts, median/ns, ave/ns, rms/ns  
 C1: 9161 -647.865 -647.865 0.962  
 C2: 0 0.000-NaN -NaN  
 P1: 9161 -647.121 -647.078 0.982  
 P2: 9004 -652.808 -652.786 1.175

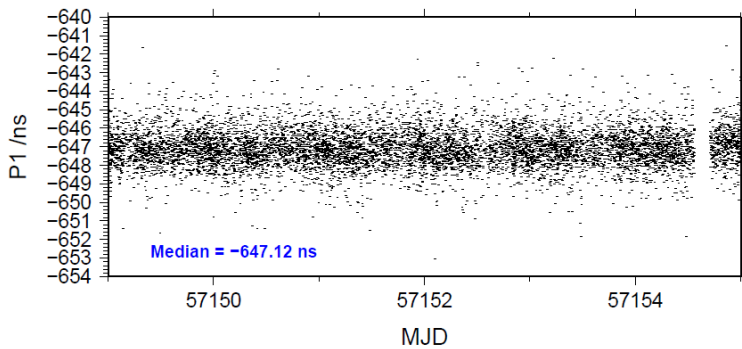
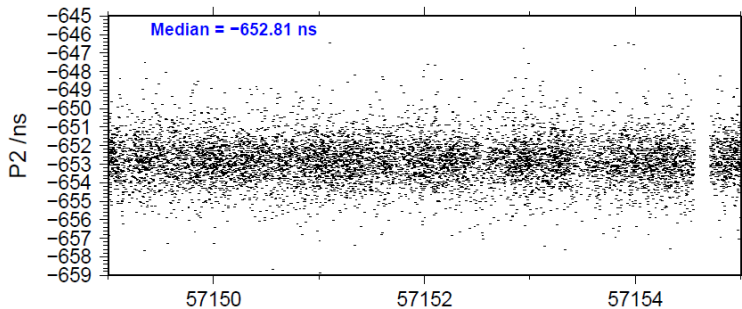
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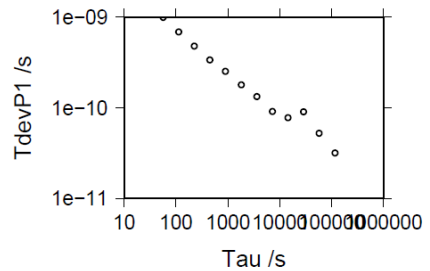
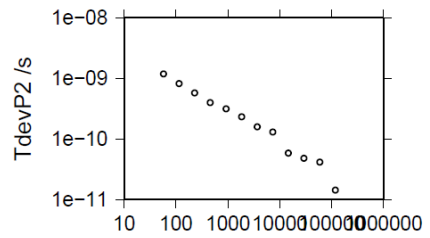
- 115837 s: C1= 28 ps
- 57919 s: C1= 61 ps
- 28959 s: C1= 105 ps
- 14480 s: C1= 66 ps
- 7240 s: C1= 78 ps
- 3620 s: C1= 111 ps
- 1810 s: C1= 170 ps
- 905 s: C1= 225 ps
- 452 s: C1= 320 ps
- 226 s: C1= 470 ps
- 113 s: C1= 676 ps
- 57 s: C1= 979 ps



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- 115837 s: P1= 32 ps      117857 s: P2= 14 ps
- 57919 s: P1= 53 ps      58929 s: P2= 42 ps
- 28959 s: P1= 90 ps      29464 s: P2= 48 ps
- 14480 s: P1= 78 ps      14732 s: P2= 59 ps
- 7240 s: P1= 91 ps      7366 s: P2= 130 ps
- 3620 s: P1= 132 ps      3683 s: P2= 159 ps
- 1810 s: P1= 180 ps      1842 s: P2= 232 ps
- 905 s: P1= 252 ps      921 s: P2= 316 ps
- 452 s: P1= 337 ps      460 s: P2= 400 ps
- 226 s: P1= 479 ps      230 s: P2= 572 ps
- 113 s: P1= 683 ps      115 s: P2= 820 ps
- 57 s: P1= 990 ps      58 s: P2= 1186 ps



BP0U-OPM7

## COMPUTATION OF BASELINE

Number of codes to fit baseline and biases = 111000  
 Computed code bias (P1/P2)/m = -126.525 -125.772  
 Computed baseline (X,Y,Z)/m = 5.147 6.069 -4.461  
 RMS of residuals /m = 0.503

Number of phase differences to fit baseline = 65640  
 A priori baseline (X,Y,Z)/m = 5.147 6.069 -4.461  
 12605 clock jitters computed out of 13208 intervals  
 AVE jitter /ps = -0.5 RMS jitter /ps = 63.4

Iter 1 Large residuals L1= 602  
 Iter 1 Large residuals L2= 602  
 Computed baseline L1 (X,Y,Z)/m = 0.192 -0.052 0.339  
 RMS of residuals L1 /m = 0.004  
 Computed baseline L2 (X,Y,Z)/m = 0.208 -0.051 0.352  
 RMS of residuals L2 /m = 0.004

Iter 2 Large residuals L1= 602  
 Iter 2 Large residuals L2= 602  
 Computed baseline L1 (X,Y,Z)/m = 0.193 -0.052 0.342  
 RMS of residuals L1 /m = 0.004  
 Computed baseline L2 (X,Y,Z)/m = 0.209 -0.051 0.354  
 RMS of residuals L2 /m = 0.004

Final baseline L1 (X,Y,Z)/m = 5.340 6.017 -4.119  
 Final baseline L2 (X,Y,Z)/m = 5.356 6.018 -4.107

## COMPUTATION OF CODE DIFFERENCES

Number of code differences = 111008

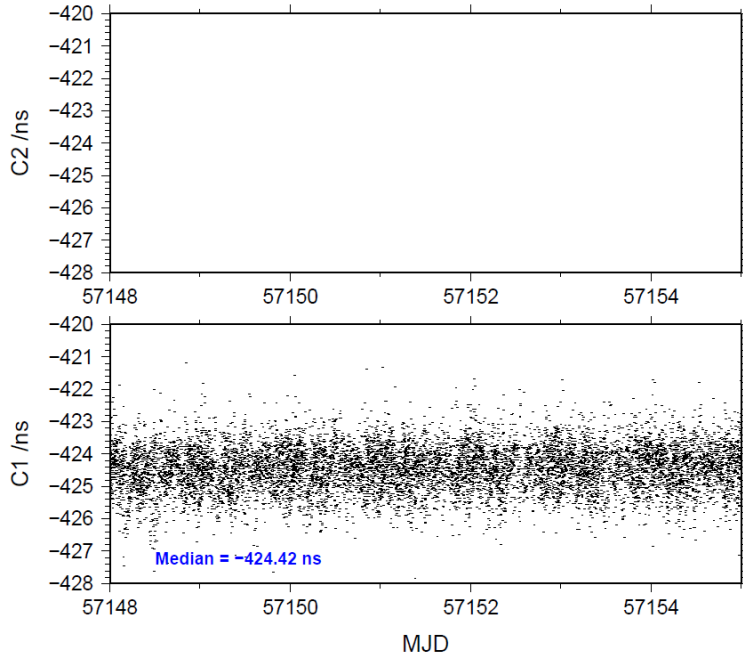
Global average of individual differences

Code #pts, ave/ns, rms/ns  
 C1: 110939 -424.445 1.151  
 C2: 0-NaN -NaN  
 P1: 110931 -423.060 1.533  
 P2: 110930 -420.602 1.919

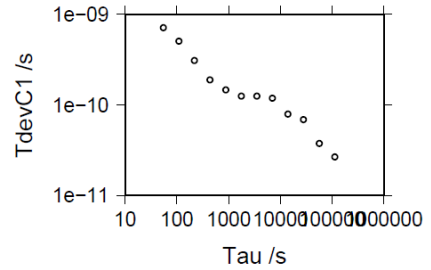
Number of 300s epochs in out file = 2016

Code #pts, median/ns, ave/ns, rms/ns  
 C1: 11002 -424.415 -424.440 0.695  
 C2: 0 0.000-NaN -NaN  
 P1: 11002 -423.096 -423.075 0.851  
 P2: 11002 -420.583 -420.588 1.176

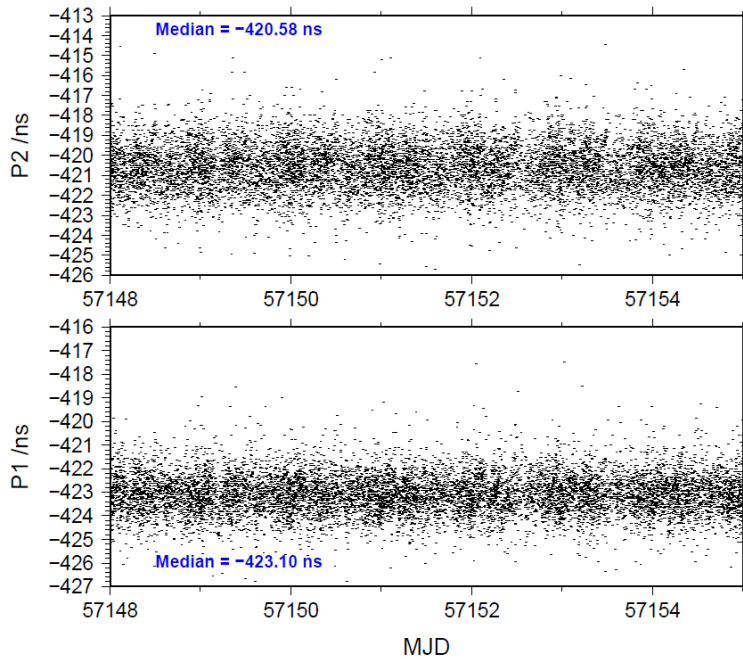
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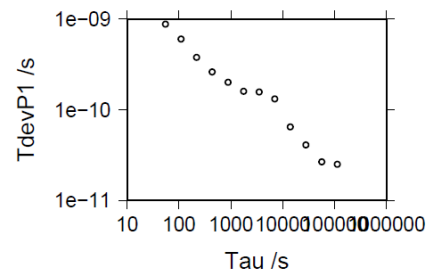
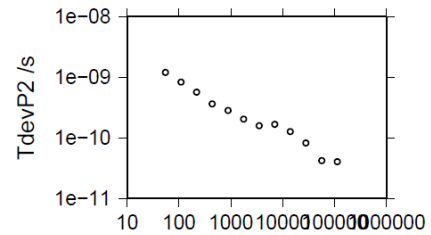
112537 s: C1= 27 ps  
56268 s: C1= 38 ps  
28134 s: C1= 69 ps  
14067 s: C1= 79 ps  
7034 s: C1= 119 ps  
3517 s: C1= 125 ps  
1758 s: C1= 125 ps  
879 s: C1= 146 ps  
440 s: C1= 189 ps  
220 s: C1= 309 ps  
110 s: C1= 503 ps  
55 s: C1= 708 ps



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112537 s: P1= 25 ps    112537 s: P2= 40 ps  
56268 s: P1= 27 ps    56268 s: P2= 42 ps  
28134 s: P1= 41 ps    28134 s: P2= 83 ps  
14067 s: P1= 65 ps    14067 s: P2= 127 ps  
7034 s: P1= 132 ps    7034 s: P2= 167 ps  
3517 s: P1= 158 ps    3517 s: P2= 159 ps  
1758 s: P1= 160 ps    1758 s: P2= 204 ps  
879 s: P1= 200 ps    879 s: P2= 283 ps  
440 s: P1= 262 ps    440 s: P2= 361 ps  
220 s: P1= 379 ps    220 s: P2= 567 ps  
110 s: P1= 604 ps    110 s: P2= 833 ps  
55 s: P1= 877 ps    55 s: P2= 1195 ps



BP0U-OPM8

## COMPUTATION OF BASELINE

Number of codes to fit baseline and biases = 110996  
 Computed code bias (P1/P2)/m = -127.595 -126.846  
 Computed baseline (X,Y,Z)/m = 5.147 6.070 -4.462  
 RMS of residuals /m = 0.504

Number of phase differences to fit baseline = 65662  
 A priori baseline (X,Y,Z)/m = 5.147 6.070 -4.462  
 12604 clock jitters computed out of 13227 intervals  
 AVE jitter /ps = -0.5 RMS jitter /ps = 63.4

Iter 1 Large residuals L1= 624  
 Iter 1 Large residuals L2= 619  
 Computed baseline L1 (X,Y,Z)/m = 0.188 -0.048 0.338  
 RMS of residuals L1 /m = 0.004  
 Computed baseline L2 (X,Y,Z)/m = 0.204 -0.046 0.349  
 RMS of residuals L2 /m = 0.004

Iter 2 Large residuals L1= 624  
 Iter 2 Large residuals L2= 619  
 Computed baseline L1 (X,Y,Z)/m = 0.193 -0.050 0.343  
 RMS of residuals L1 /m = 0.004  
 Computed baseline L2 (X,Y,Z)/m = 0.204 -0.046 0.351  
 RMS of residuals L2 /m = 0.004

Final baseline L1 (X,Y,Z)/m = 5.341 6.020 -4.119  
 Final baseline L2 (X,Y,Z)/m = 5.351 6.024 -4.112

## COMPUTATION OF CODE DIFFERENCES

Number of code differences = 111004

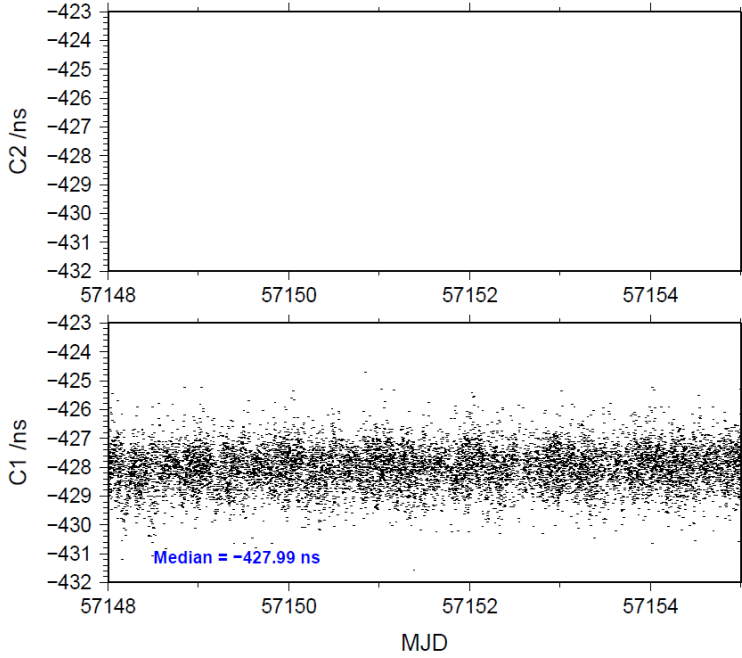
Global average of individual differences

Code #pts, ave/ns, rms/ns  
 C1: 110935 -428.021 1.152  
 C2: 0-NaN -NaN  
 P1: 110927 -426.634 1.533  
 P2: 110926 -424.171 1.918

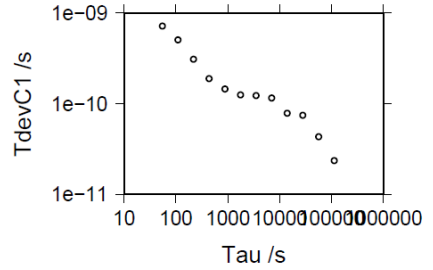
Number of 300s epochs in out file = 2016

Code #pts, median/ns, ave/ns, rms/ns  
 C1: 11001 -427.991 -428.018 0.697  
 C2: 0 0.000-NaN -NaN  
 P1: 11001 -426.670 -426.647 0.853  
 P2: 11001 -424.160 -424.156 1.176

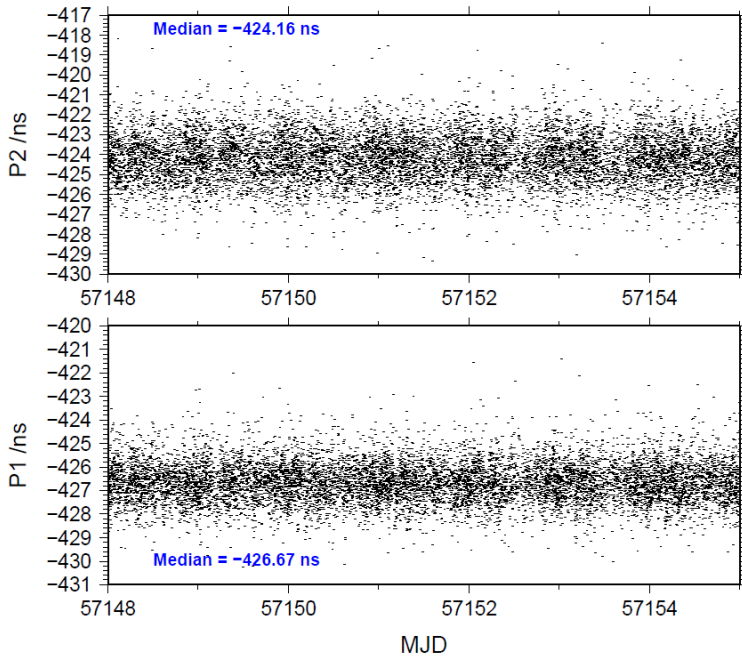
05/20/15 bp0uopm815126\_7



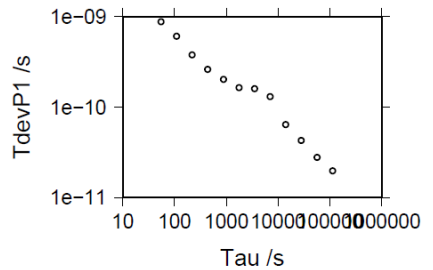
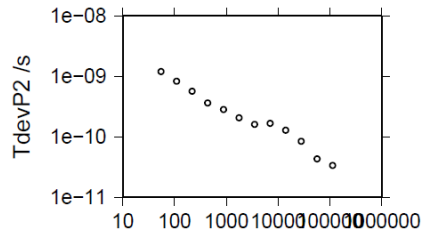
112547 s: C1= 24 ps  
 56273 s: C1= 43 ps  
 28137 s: C1= 75 ps  
 14068 s: C1= 79 ps  
 7034 s: C1= 116 ps  
 3517 s: C1= 123 ps  
 1759 s: C1= 125 ps  
 879 s: C1= 146 ps  
 440 s: C1= 190 ps  
 220 s: C1= 309 ps  
 110 s: C1= 503 ps  
 55 s: C1= 714 ps



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112547 s: P1= 20 ps    112547 s: P2= 33 ps  
 56273 s: P1= 28 ps    56273 s: P2= 43 ps  
 28137 s: P1= 43 ps    28137 s: P2= 85 ps  
 14068 s: P1= 64 ps    14068 s: P2= 128 ps  
 7034 s: P1= 130 ps    7034 s: P2= 167 ps  
 3517 s: P1= 160 ps    3517 s: P2= 160 ps  
 1759 s: P1= 164 ps    1759 s: P2= 205 ps  
 879 s: P1= 202 ps    879 s: P2= 282 ps  
 440 s: P1= 262 ps    440 s: P2= 361 ps  
 220 s: P1= 379 ps    220 s: P2= 567 ps  
 110 s: P1= 604 ps    110 s: P2= 833 ps  
 55 s: P1= 879 ps    55 s: P2= 1195 ps



BP1C-OPMT

## COMPUTATION OF BASELINE

Number of codes to fit baseline and biases = 127781  
 Computed code bias (P1/P2)/m = -180.217 -182.270  
 Computed baseline (X,Y,Z)/m = 0.313 3.235 -2.324  
 RMS of residuals /m = 0.615

Number of phase differences to fit baseline = 127125  
 A priori baseline (X,Y,Z)/m = 0.313 3.235 -2.324  
 16829 clock jitters computed out of 16829 intervals  
 AVE jitter /ps = -0.1 RMS jitter /ps = 5.0

Iter 1 Large residuals L1= 0  
 Iter 1 Large residuals L2= 0  
 Computed baseline L1 (X,Y,Z)/m = 0.176 0.054 0.086  
 RMS of residuals L1 /m = 0.003  
 Computed baseline L2 (X,Y,Z)/m = 0.173 0.050 0.085  
 RMS of residuals L2 /m = 0.004

Final baseline L1 (X,Y,Z)/m = 0.489 3.289 -2.237  
 Final baseline L2 (X,Y,Z)/m = 0.486 3.284 -2.239

## COMPUTATION OF CODE DIFFERENCES

Number of code differences = 130135

Global average of individual differences

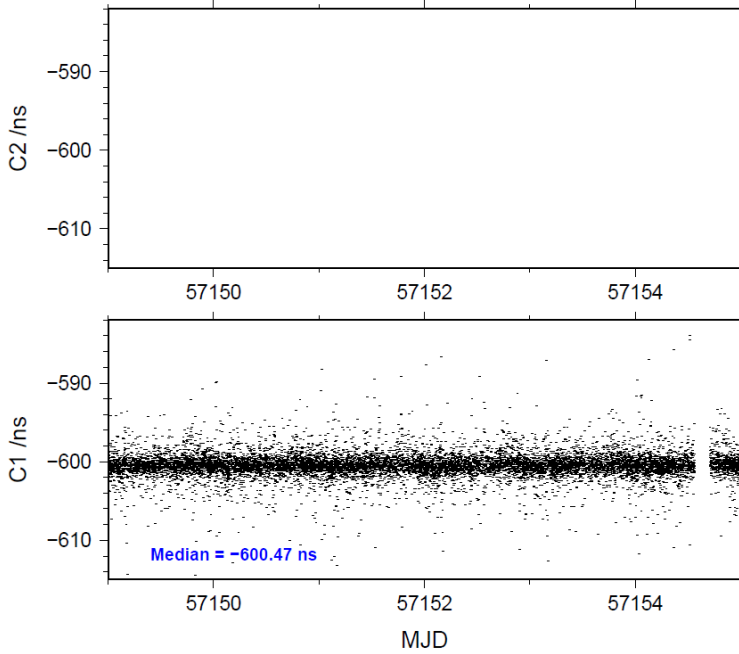
Code #pts, ave/ns, rms/ns  
 C1: 128343 -600.442 3.376  
 C2: 0-NaN -NaN  
 P1: 127784 -601.536 2.517  
 P2: 125897 -607.637 2.610

Number of 300s epochs in out file = 1686

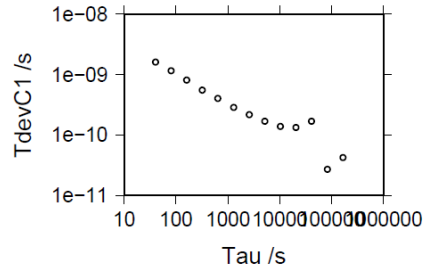
Code #pts, median/ns, ave/ns, rms/ns  
 C1: 12851 -600.470 -600.464 1.625  
 C2: 0 0.000-NaN -NaN  
 P1: 12755 -601.616 -601.551 1.256  
 P2: 12575 -607.635 -607.656 1.387



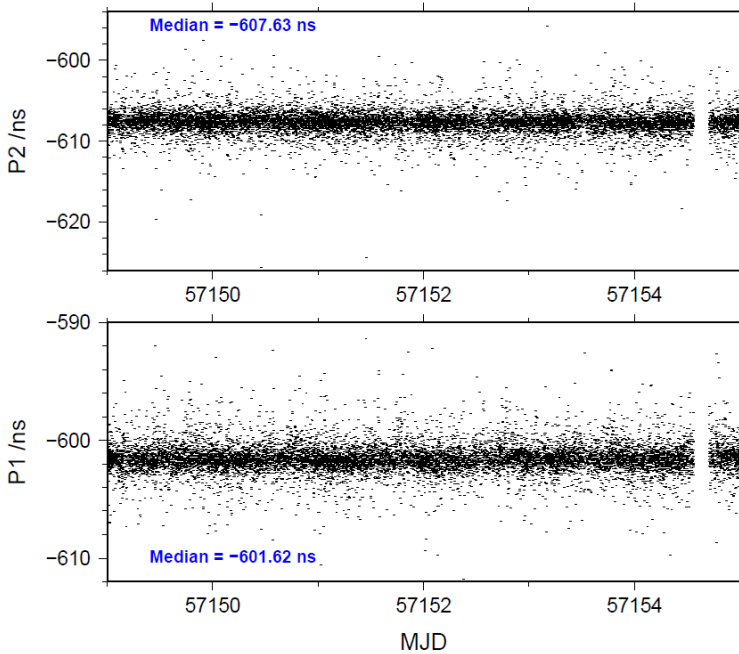
05/18/15 bp1copmt15126\_7



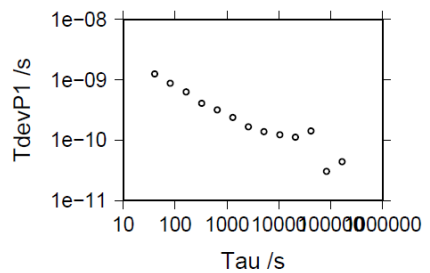
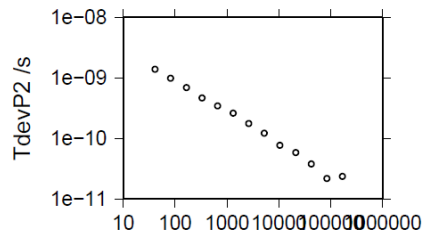
- 165147 s: C1= 42 ps
- 82573 s: C1= 27 ps
- 41287 s: C1= 168 ps
- 20643 s: C1= 133 ps
- 10322 s: C1= 138 ps
- 5161 s: C1= 169 ps
- 2580 s: C1= 217 ps
- 1290 s: C1= 288 ps
- 645 s: C1= 402 ps
- 323 s: C1= 552 ps
- 161 s: C1= 813 ps
- 81 s: C1= 1149 ps
- 40 s: C1= 1606 ps



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- 166390 s: P1= 44 ps
- 83195 s: P1= 31 ps
- 41597 s: P1= 143 ps
- 20799 s: P1= 112 ps
- 10399 s: P1= 124 ps
- 5200 s: P1= 139 ps
- 2600 s: P1= 167 ps
- 1300 s: P1= 239 ps
- 650 s: P1= 319 ps
- 325 s: P1= 410 ps
- 162 s: P1= 632 ps
- 81 s: P1= 878 ps
- 41 s: P1= 1246 ps
- 168772 s: P2= 24 ps
- 84386 s: P2= 22 ps
- 42193 s: P2= 38 ps
- 21096 s: P2= 58 ps
- 10548 s: P2= 77 ps
- 5274 s: P2= 121 ps
- 2637 s: P2= 177 ps
- 1319 s: P2= 261 ps
- 659 s: P2= 346 ps
- 330 s: P2= 464 ps
- 165 s: P2= 696 ps
- 82 s: P2= 985 ps
- 41 s: P2= 1389 ps



BP1C-OPM7

## COMPUTATION OF BASELINE

Number of codes to fit baseline and biases = 165613  
 Computed code bias (P1/P2)/m = -112.942 -112.291  
 Computed baseline (X,Y,Z)/m = 5.209 4.937 -4.280  
 RMS of residuals /m = 0.486

Number of phase differences to fit baseline = 164749  
 A priori baseline (X,Y,Z)/m = 5.209 4.937 -4.280  
 20153 clock jitters computed out of 20153 intervals  
 AVE jitter /ps = -0.6 RMS jitter /ps = 5.6

Iter 1 Large residuals L1= 0  
 Iter 1 Large residuals L2= 0  
 Computed baseline L1 (X,Y,Z)/m = 0.223 0.052 0.313  
 RMS of residuals L1 /m = 0.004  
 Computed baseline L2 (X,Y,Z)/m = 0.227 0.047 0.314  
 RMS of residuals L2 /m = 0.005

Final baseline L1 (X,Y,Z)/m = 5.432 4.989 -3.967  
 Final baseline L2 (X,Y,Z)/m = 5.436 4.984 -3.967

## COMPUTATION OF CODE DIFFERENCES

Number of code differences = 167875

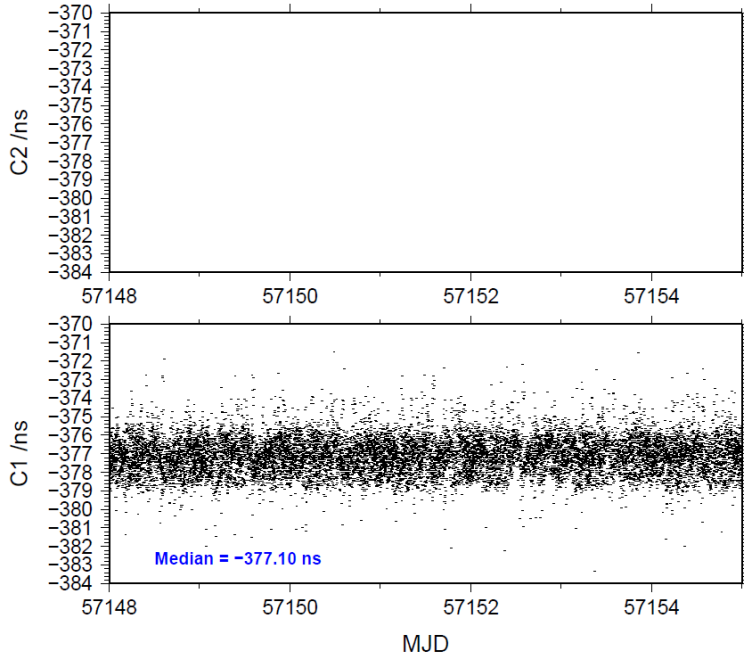
Global average of individual differences

Code #pts, ave/ns, rms/ns  
 C1: 166259 -377.090 1.513  
 C2: 0 -NaN -NaN  
 P1: 165534 -377.644 1.636  
 P2: 165480 -375.474 1.903

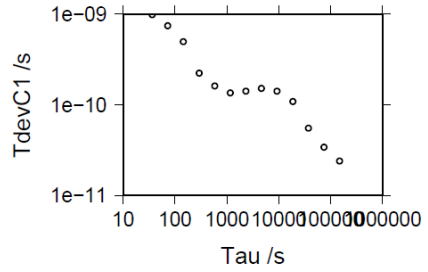
Number of 300s epochs in out file = 2016

Code #pts, median/ns, ave/ns, rms/ns  
 C1: 16610 -377.101 -377.097 0.979  
 C2: 0 0.000 -NaN -NaN  
 P1: 16534 -377.657 -377.655 1.091  
 P2: 16527 -375.517 -375.476 1.392

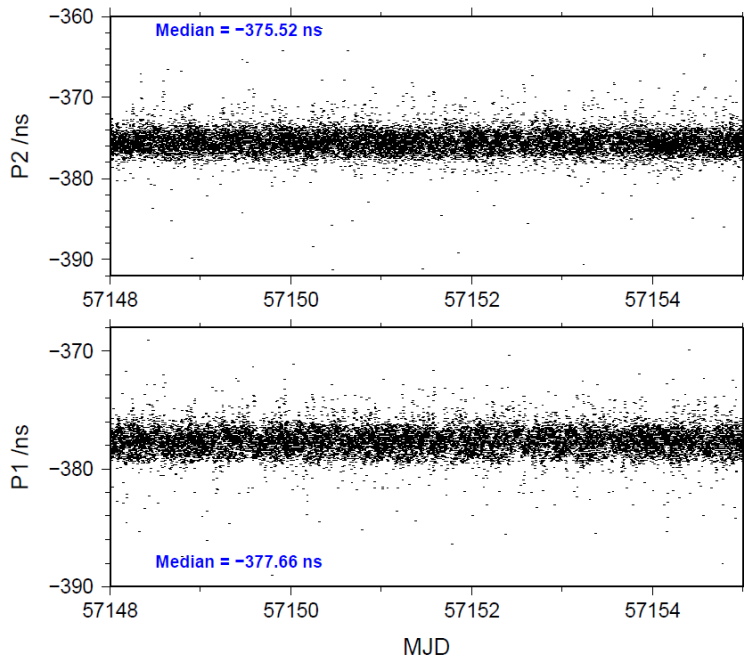
05/20/15 bp1copm715126\_7



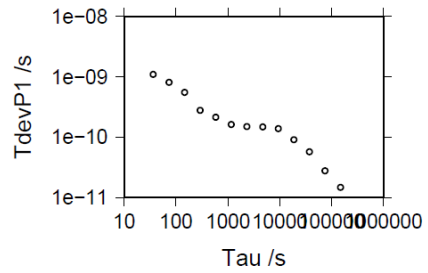
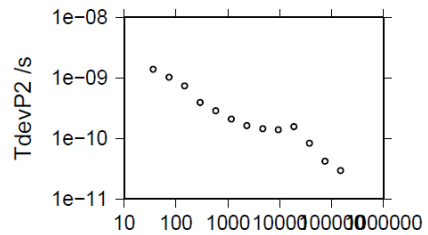
- 149078 s: C1= 24 ps
- 74539 s: C1= 34 ps
- 37269 s: C1= 55 ps
- 18635 s: C1= 109 ps
- 9317 s: C1= 142 ps
- 4659 s: C1= 152 ps
- 2329 s: C1= 142 ps
- 1165 s: C1= 135 ps
- 582 s: C1= 162 ps
- 291 s: C1= 223 ps
- 146 s: C1= 494 ps
- 73 s: C1= 740 ps
- 36 s: C1= 979 ps



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- 149763 s: P1= 15 ps    149826 s: P2= 30 ps
- 74882 s: P1= 28 ps    74913 s: P2= 42 ps
- 37441 s: P1= 58 ps    37457 s: P2= 84 ps
- 18720 s: P1= 91 ps    18728 s: P2= 156 ps
- 9360 s: P1= 139 ps    9364 s: P2= 139 ps
- 4680 s: P1= 149 ps    4682 s: P2= 145 ps
- 2340 s: P1= 149 ps    2341 s: P2= 163 ps
- 1170 s: P1= 162 ps    1171 s: P2= 208 ps
- 585 s: P1= 214 ps    585 s: P2= 287 ps
- 293 s: P1= 278 ps    293 s: P2= 393 ps
- 146 s: P1= 550 ps    146 s: P2= 734 ps
- 73 s: P1= 815 ps    73 s: P2= 1024 ps
- 37 s: P1= 1097 ps    37 s: P2= 1382 ps



BP1C-OPM8

## COMPUTATION OF BASELINE

Number of codes to fit baseline and biases = 165443  
 Computed code bias (P1/P2)/m = -114.013 -113.366  
 Computed baseline (X,Y,Z)/m = 5.212 4.940 -4.284  
 RMS of residuals /m = 0.485

Number of phase differences to fit baseline = 164565  
 A priori baseline (X,Y,Z)/m = 5.212 4.940 -4.284  
 20153 clock jitters computed out of 20153 intervals  
 AVE jitter /ps = -0.6 RMS jitter /ps = 5.5

Iter 1 Large residuals L1= 0  
 Iter 1 Large residuals L2= 0  
 Computed baseline L1 (X,Y,Z)/m = 0.222 0.048 0.316  
 RMS of residuals L1 /m = 0.004  
 Computed baseline L2 (X,Y,Z)/m = 0.226 0.042 0.317  
 RMS of residuals L2 /m = 0.005

Final baseline L1 (X,Y,Z)/m = 5.434 4.988 -3.968  
 Final baseline L2 (X,Y,Z)/m = 5.438 4.982 -3.968

## COMPUTATION OF CODE DIFFERENCES

Number of code differences = 167684

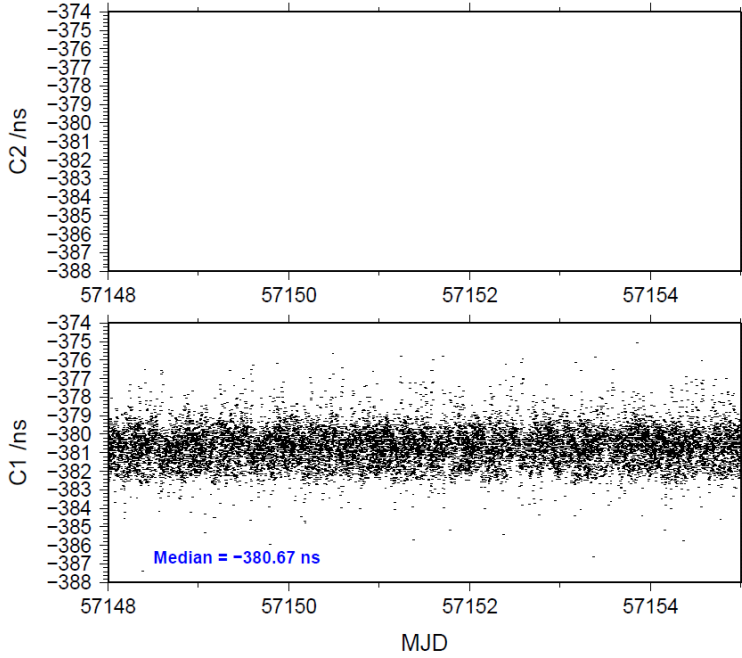
Global average of individual differences

Code #pts, ave/ns, rms/ns  
 C1: 166068 -380.665 1.507  
 C2: 0 -NaN -NaN  
 P1: 165364 -381.217 1.633  
 P2: 165316 -379.064 1.895

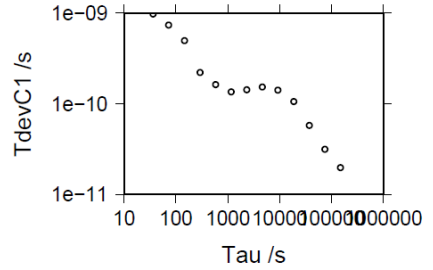
Number of 300s epochs in out file = 2016

Code #pts, median/ns, ave/ns, rms/ns  
 C1: 16588 -380.674 -380.674 0.974  
 C2: 0 0.000 -NaN -NaN  
 P1: 16517 -381.234 -381.230 1.091  
 P2: 16511 -379.103 -379.067 1.387

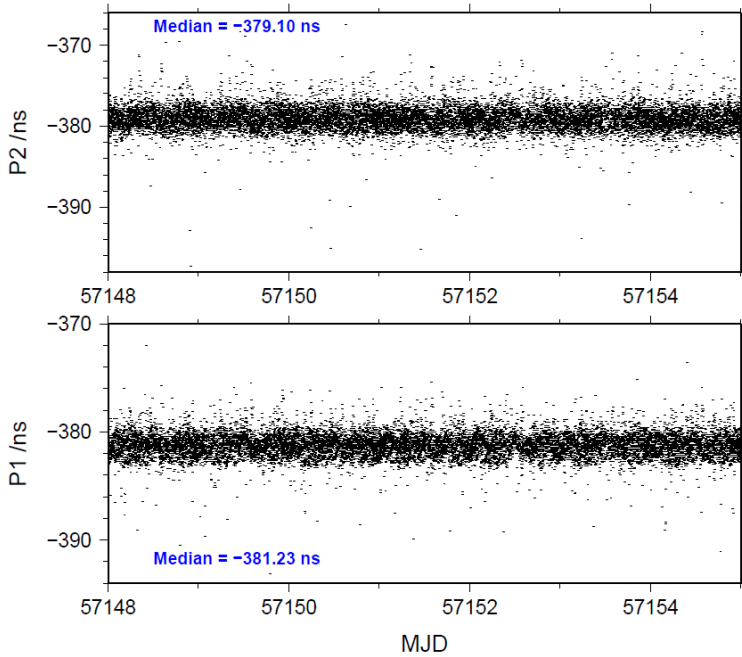
05/20/15 bp1copm815126\_7



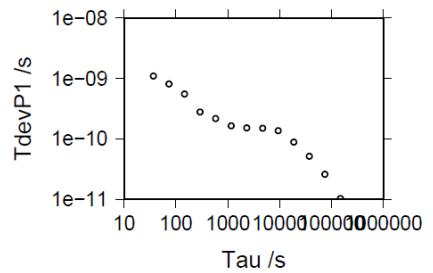
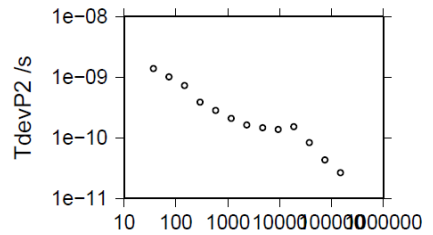
- 149275 s: C1= 20 ps
- 74638 s: C1= 31 ps
- 37319 s: C1= 58 ps
- 18659 s: C1= 105 ps
- 9330 s: C1= 141 ps
- 4665 s: C1= 152 ps
- 2332 s: C1= 143 ps
- 1166 s: C1= 136 ps
- 583 s: C1= 162 ps
- 292 s: C1= 222 ps
- 146 s: C1= 495 ps
- 73 s: C1= 738 ps
- 36 s: C1= 973 ps



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- 149917 s: P1= 10 ps
- 74959 s: P1= 26 ps
- 37479 s: P1= 52 ps
- 18740 s: P1= 89 ps
- 9370 s: P1= 137 ps
- 4685 s: P1= 149 ps
- 2342 s: P1= 152 ps
- 1171 s: P1= 166 ps
- 586 s: P1= 216 ps
- 293 s: P1= 277 ps
- 146 s: P1= 550 ps
- 73 s: P1= 814 ps
- 37 s: P1= 1098 ps
- 149972 s: P2= 26 ps
- 74986 s: P2= 43 ps
- 37493 s: P2= 84 ps
- 18746 s: P2= 153 ps
- 9373 s: P2= 136 ps
- 4687 s: P2= 146 ps
- 2343 s: P2= 163 ps
- 1172 s: P2= 208 ps
- 586 s: P2= 284 ps
- 293 s: P2= 389 ps
- 146 s: P2= 731 ps
- 73 s: P2= 1018 ps
- 37 s: P2= 1380 ps



**4.7/ PTB (15159)**Period

MJD 57181 to 57188

Delays

## BP0U:

$$\text{REFDLY} = X_P = 35.1 + 52.6 = 87.7 \text{ ns} \quad (35.1 + \text{BP1R} + \text{C166} + \text{BP1I} + \text{C153})$$

$$\text{CABDLY} = X_C = 182.0 \text{ ns} \quad (\text{C134})$$

## BP1C:

$$X_O = 192.9 \text{ ns}$$

$$X_P = 35.1 + 52.6 = 87.7 \text{ ns} \quad (35.1 + \text{BP1R} + \text{C166} + \text{BP1I} + \text{C157})$$

$$\text{REFDLY} = 280.6 \text{ ns}$$

$$\text{CABDLY} = X_C = 235.7 \text{ ns} \quad (\text{C131})$$

## PTBB:

$$X_O = 38.1 + 15.8 = 53.9 \text{ ns}$$

$$X_P = 20.1 \text{ ns}$$

$$\text{REFDLY} = 74.0 \text{ ns}$$

$$\text{CABDLY} = 301.7 \text{ ns}$$

## PTBG:

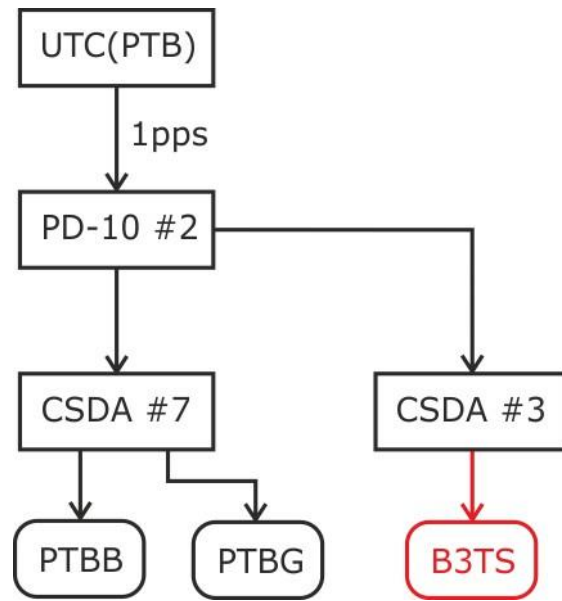
$$X_O = 10.3 + 15.8 = 26.1 \text{ ns}$$

$$X_P = 20.2 \text{ ns}$$

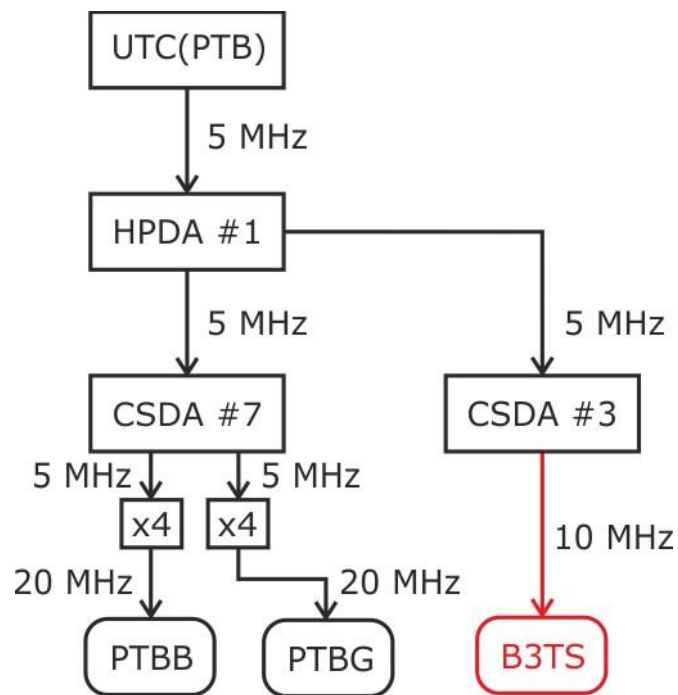
$$\text{REFDLY} = 46.3 \text{ ns}$$

$$\text{CABDLY} = 251.4 \text{ ns}$$

Setup at the PTB



**Figure 1:** Signal distribution (1pps) to PTBB, PTBG and B3TS



**Figure 2:** Signal distribution (5 MHz, 10 MHz, 20 MHz) to PTBB, PTBG and B3TS

|   |                                |
|---|--------------------------------|
| Laboratory:                                     | PTB                            |
| Date and hour of the beginning of measurements: | 2015-06-08 (approx. 10:00 UTC) |
| Date and hour of the end of measurements:       | 2015-06-15 (approx. 07:00 UTC) |

### Information on the system

|                                 | <b>Local:</b> (1) PTBB (2) PTBG  | <b>Travelling:</b> (1) BPOU, (2) BP1C |
|---------------------------------|----------------------------------|---------------------------------------|
| • Receiver maker:               | (1)+(2) ASHTECH                  | (1) Dicom, (2) Septentrio             |
| Receiver type:                  | (1)+(2) Z-XII3T                  | (1) GTR50, (2) PolaRx3e TR            |
| Receiver serial number:         | (1) RT820013901, (2) RT920032501 | (1) 0801068, (2) S9000169176          |
| 1 PPS trigger level /V:         | 1 V                              | 1 V                                   |
| • Antenna cable maker:          | (1) Nokia, (2) Belden            |                                       |
| Antenna cable type :            | (1) RG214, (2) RG8               | LMR600                                |
| Phase stabilised cable (Y/N):   |                                  |                                       |
| Length outside the building /m: | approx. 25 m                     | approx. 25 m                          |
| • Antenna maker:                | (1) Ashtech, (2) Ashtech         | (1) Novatel, (2) Ashtech              |
| Antenna type:                   | (1) ASH700936 SNOW               | (1) GPS-702 GG                        |
| Antenna serial number:          | (1) CR15930                      | (1) NAE 10190011, (2) CR 6200323008   |
| Temperature (if stabilised) /°C |                                  |                                       |

### Measured delays /ns

|   | <b>Local:</b>          | <b>Travelling:</b>     |
|---|------------------------|------------------------|
| • Delay from local UTC to receiver 1 PPS-in ( $X_p$ )               | see report for details | see report for details |
| Delay from 1 PPS-in to internal Reference (if different): ( $X_o$ ) |                        |                        |
| • Antenna cable delay: ( $X_c$ )                                    |                        |                        |
| Splitter delay (if any):  |                        |                        |
| Additional cable delay (if any):                                    |                        |                        |



| <b>Data used for the generation of CGGTTS files</b> |                |            |
|---|----------------|------------|
|   | LOCAL:         | Travelling |
| • INT DLY (or $X_R+X_S$ ) (GPS) /ns:                |                |            |
| • INT DLY (or $X_R+X_S$ ) (GLONASS) /ns:            |                |            |
| • CAB DLY (or $X_C$ ) /ns:                          |                |            |
| • REF DLY (or $X_P+X_O$ ) /ns:                      |                |            |
| • Coordinates reference frame:                      |                |            |
| Latitude or X /m:                                   |                |            |
| Longitude or Y /m:                                  |                |            |
| Height or Z /m:                                     |                |            |
| <b>General information</b>                          |                |            |
| Rise time of the local UTC pulse:                   | < 5 ns         |            |
| • Is the laboratory air conditioned:                | yes            |            |
| Set temperature value and uncertainty:              | 23 °C ± 0.5 °C |            |
| Set humidity value and uncertainty:                 |                |            |

BP0U-PTBB

## COMPUTATION OF BASELINE

Number of codes to fit baseline and biases = 107843  
 Computed code bias (P1/P2)/m = -171.980 -174.888  
 Computed baseline (X,Y,Z)/m = 3.102 -2.756 -2.308  
 RMS of residuals /m = 0.575

Number of phase differences to fit baseline = 101159  
 A priori baseline (X,Y,Z)/m = 3.102 -2.756 -2.308  
 18740 clock jitters computed out of 18760 intervals  
 AVE jitter /ps = 0.0 RMS jitter /ps = 30.1

Iter 1 Large residuals L1= 0  
 Iter 1 Large residuals L2= 0  
 Computed baseline L1 (X,Y,Z)/m = 0.124 0.013 0.174  
 RMS of residuals L1 /m = 0.004  
 Computed baseline L2 (X,Y,Z)/m = 0.119 0.015 0.178  
 RMS of residuals L2 /m = 0.003

Final baseline L1 (X,Y,Z)/m = 3.225 -2.743 -2.133  
 Final baseline L2 (X,Y,Z)/m = 3.220 -2.740 -2.130

## COMPUTATION OF CODE DIFFERENCES

Number of code differences = 107879

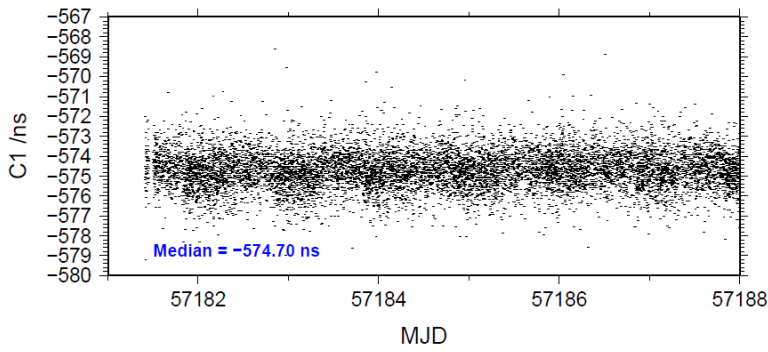
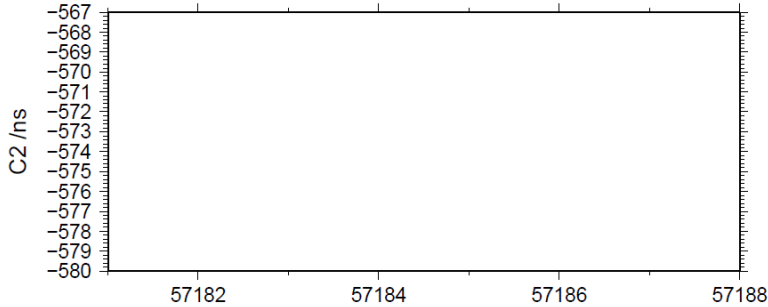
Global average of individual differences

Code #pts, ave/ns, rms/ns  
 C1: 107831 -574.672 2.260  
 C2: 0-NaN -NaN  
 P1: 107795 -574.163 1.914  
 P2: 107798 -583.861 2.133

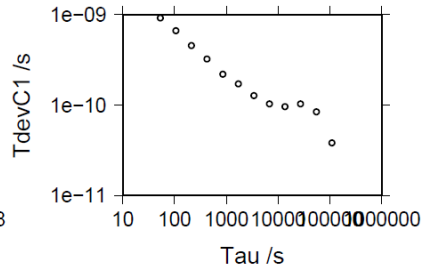
Number of 300s epochs in out file = 1886

Code #pts, median/ns, ave/ns, rms/ns  
 C1: 10684 -574.696 -574.691 0.935  
 C2: 0 0.000-NaN -NaN  
 P1: 10683 -574.204 -574.185 0.858  
 P2: 10683 -583.887 -583.863 1.020

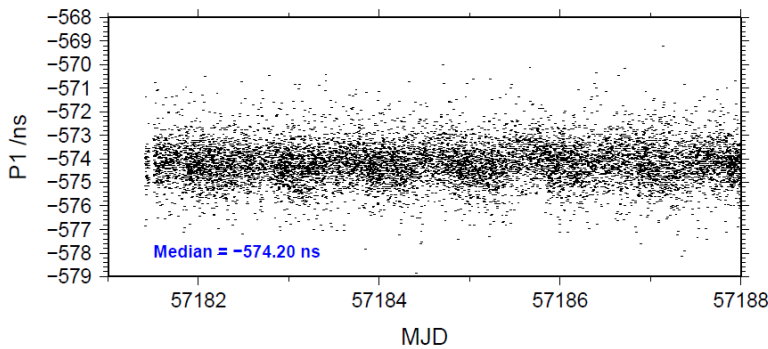
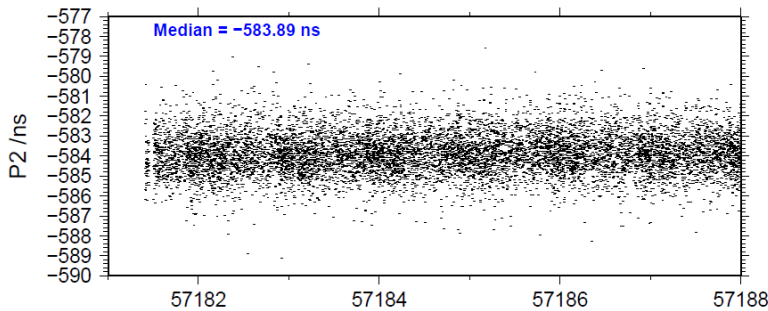
06/16/15 bp0uptbb15159\_7



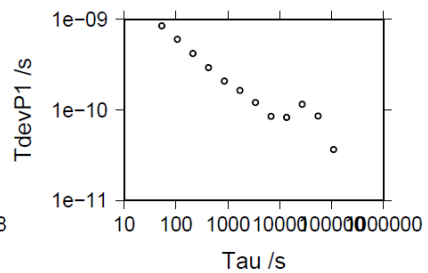
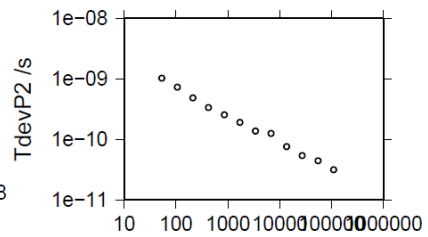
- 109100 s: C1= 38 ps
- 54550 s: C1= 84 ps
- 27275 s: C1= 103 ps
- 13638 s: C1= 96 ps
- 6819 s: C1= 103 ps
- 3409 s: C1= 128 ps
- 1705 s: C1= 171 ps
- 852 s: C1= 220 ps
- 426 s: C1= 322 ps
- 213 s: C1= 454 ps
- 107 s: C1= 662 ps
- 53 s: C1= 919 ps



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- 109110 s: P1= 36 ps    109110 s: P2= 31 ps
- 54555 s: P1= 86 ps    54555 s: P2= 45 ps
- 27278 s: P1= 116 ps    27278 s: P2= 54 ps
- 13639 s: P1= 83 ps    13639 s: P2= 76 ps
- 6819 s: P1= 85 ps    6819 s: P2= 125 ps
- 3410 s: P1= 121 ps    3410 s: P2= 138 ps
- 1705 s: P1= 163 ps    1705 s: P2= 190 ps
- 852 s: P1= 208 ps    852 s: P2= 256 ps
- 426 s: P1= 293 ps    426 s: P2= 333 ps
- 213 s: P1= 419 ps    213 s: P2= 484 ps
- 107 s: P1= 602 ps    107 s: P2= 732 ps
- 53 s: P1= 845 ps    53 s: P2= 1022 ps



BP0U-PTBG

## COMPUTATION OF BASELINE

Number of codes to fit baseline and biases = 107728  
 Computed code bias (P1/P2)/m = -164.331 -169.370  
 Computed baseline (X,Y,Z)/m = 7.523 -6.485 -5.344  
 RMS of residuals /m = 0.589

Number of phase differences to fit baseline = 101096  
 A priori baseline (X,Y,Z)/m = 7.523 -6.485 -5.344  
 18739 clock jitters computed out of 18763 intervals  
 AVE jitter /ps = 0.1 RMS jitter /ps = 30.1

Iter 1 Large residuals L1= 1  
 Iter 1 Large residuals L2= 1  
 Computed baseline L1 (X,Y,Z)/m = 0.115 0.027 0.178  
 RMS of residuals L1 /m = 0.004  
 Computed baseline L2 (X,Y,Z)/m = 0.113 0.028 0.181  
 RMS of residuals L2 /m = 0.003

Iter 2 Large residuals L1= 1  
 Iter 2 Large residuals L2= 1  
 Computed baseline L1 (X,Y,Z)/m = 0.115 0.027 0.178  
 RMS of residuals L1 /m = 0.004  
 Computed baseline L2 (X,Y,Z)/m = 0.113 0.028 0.181  
 RMS of residuals L2 /m = 0.003

Final baseline L1 (X,Y,Z)/m = 7.638 -6.458 -5.166  
 Final baseline L2 (X,Y,Z)/m = 7.636 -6.457 -5.163

## COMPUTATION OF CODE DIFFERENCES

Number of code differences = 107767

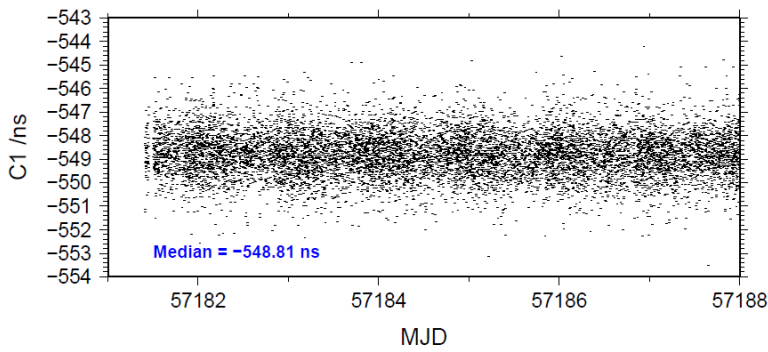
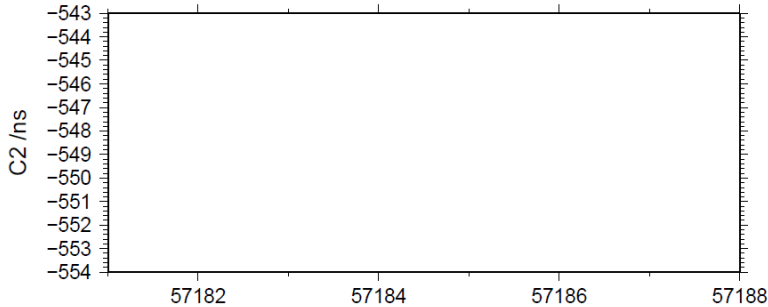
Global average of individual differences

Code #pts, ave/ns, rms/ns  
 C1: 107717 -548.767 2.245  
 C2: 0-NaN -NaN  
 P1: 107683 -548.640 1.972  
 P2: 107684 -565.452 2.183

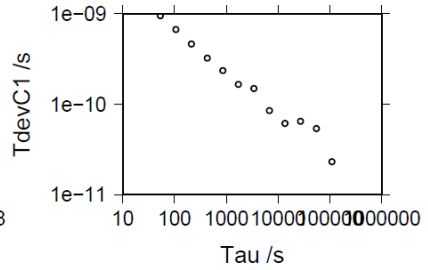
Number of 300s epochs in out file = 1886

Code #pts, median/ns, ave/ns, rms/ns  
 C1: 10673 -548.809 -548.793 0.944  
 C2: 0 0.000-NaN -NaN  
 P1: 10673 -548.684 -548.666 0.901  
 P2: 10673 -565.482 -565.451 1.057

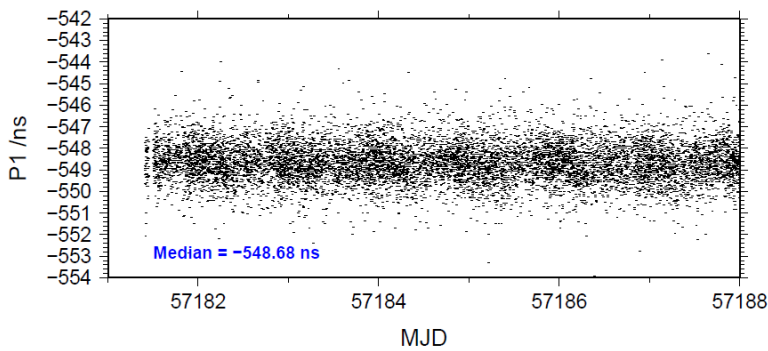
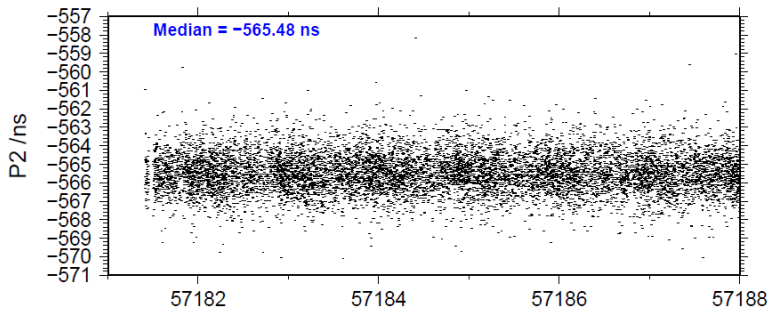
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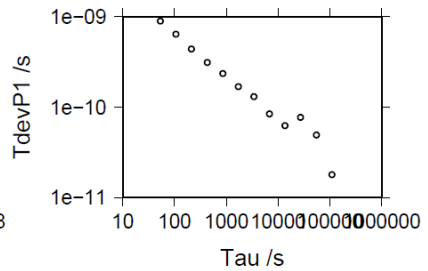
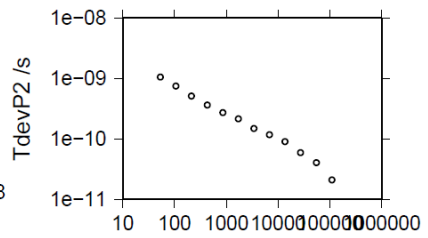
- 109213 s: C1= 23 ps
- 54606 s: C1= 54 ps
- 27303 s: C1= 65 ps
- 13652 s: C1= 61 ps
- 6826 s: C1= 85 ps
- 3413 s: C1= 148 ps
- 1706 s: C1= 165 ps
- 853 s: C1= 235 ps
- 427 s: C1= 321 ps
- 213 s: C1= 463 ps
- 107 s: C1= 668 ps
- 53 s: C1= 945 ps



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- |                     |                     |
|---------------------|---------------------|
| 109213 s: P1= 18 ps | 109213 s: P2= 21 ps |
| 54606 s: P1= 49 ps  | 54606 s: P2= 40 ps  |
| 27303 s: P1= 78 ps  | 27303 s: P2= 59 ps  |
| 13652 s: P1= 62 ps  | 13652 s: P2= 90 ps  |
| 6826 s: P1= 84 ps   | 6826 s: P2= 117 ps  |
| 3413 s: P1= 131 ps  | 3413 s: P2= 149 ps  |
| 1706 s: P1= 168 ps  | 1706 s: P2= 214 ps  |
| 853 s: P1= 235 ps   | 853 s: P2= 273 ps   |
| 427 s: P1= 311 ps   | 427 s: P2= 365 ps   |
| 213 s: P1= 438 ps   | 213 s: P2= 511 ps   |
| 107 s: P1= 637 ps   | 107 s: P2= 745 ps   |
| 53 s: P1= 896 ps    | 53 s: P2= 1055 ps   |



BP1C-PTBB

## COMPUTATION OF BASELINE

Number of codes to fit baseline and biases = 156466  
 Computed code bias (P1/P2)/m = -158.213 -161.161  
 Computed baseline (X,Y,Z)/m = 2.029 -1.812 -1.521  
 RMS of residuals /m = 0.575

Number of phase differences to fit baseline = 156014  
 A priori baseline (X,Y,Z)/m = 2.029 -1.812 -1.521  
 19781 clock jitters computed out of 19781 intervals  
 AVE jitter /ps = 0.0 RMS jitter /ps = 4.3

Iter 1 Large residuals L1= 0  
 Iter 1 Large residuals L2= 1  
 Computed baseline L1 (X,Y,Z)/m = 0.067 0.031 0.068  
 RMS of residuals L1 /m = 0.004  
 Computed baseline L2 (X,Y,Z)/m = 0.067 0.037 0.069  
 RMS of residuals L2 /m = 0.004

Iter 2 Large residuals L1= 0  
 Iter 2 Large residuals L2= 1  
 Computed baseline L1 (X,Y,Z)/m = 0.067 0.031 0.068  
 RMS of residuals L1 /m = 0.004  
 Computed baseline L2 (X,Y,Z)/m = 0.067 0.037 0.069  
 RMS of residuals L2 /m = 0.004

Final baseline L1 (X,Y,Z)/m = 2.096 -1.781 -1.453  
 Final baseline L2 (X,Y,Z)/m = 2.096 -1.775 -1.453

## COMPUTATION OF CODE DIFFERENCES

Number of code differences = 161439

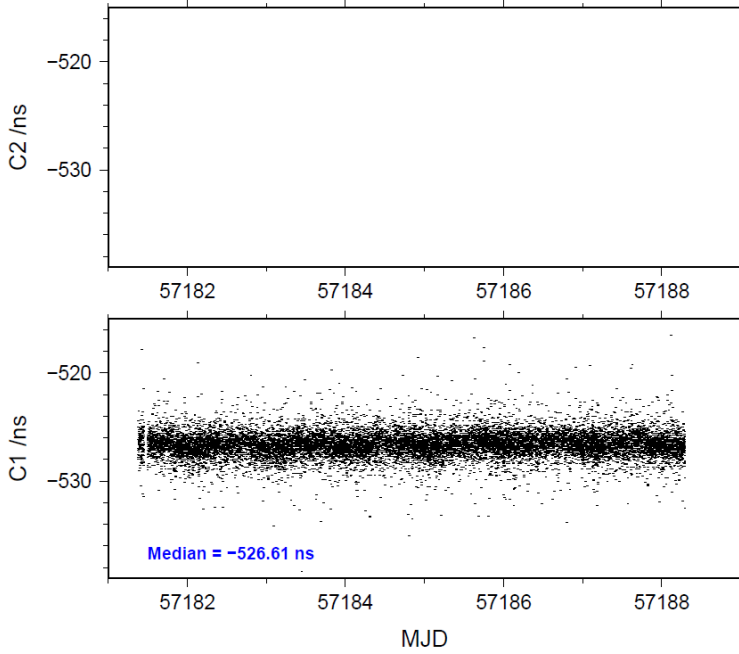
Global average of individual differences

Code #pts, ave/ns, rms/ns  
 C1: 160165 -526.597 3.069  
 C2: 0-NaN -NaN  
 P1: 156930 -527.957 2.281  
 P2: 156618 -537.794 2.322

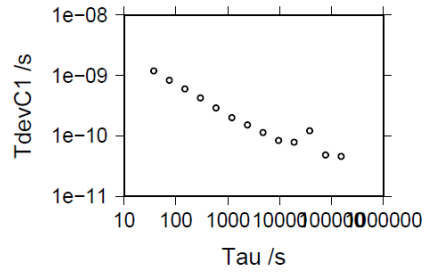
Number of 300s epochs in out file = 1981

Code #pts, median/ns, ave/ns, rms/ns  
 C1: 16009 -526.614 -526.618 1.199  
 C2: 0 0.000-NaN -NaN  
 P1: 15678 -528.005 -527.973 0.958  
 P2: 15637 -537.826 -537.809 1.065

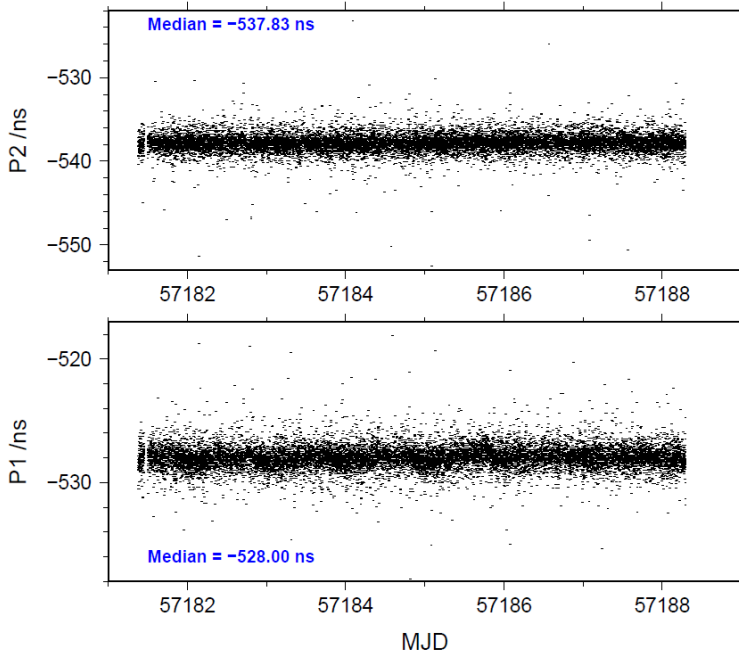
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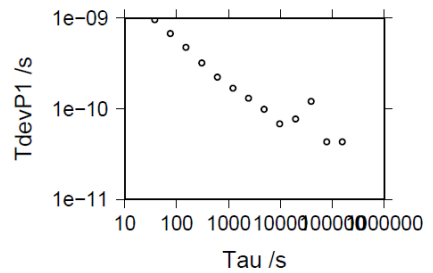
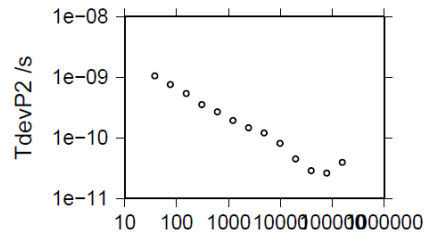
- 152909 s: C1= 46 ps
- 76455 s: C1= 49 ps
- 38227 s: C1= 122 ps
- 19114 s: C1= 79 ps
- 9557 s: C1= 85 ps
- 4778 s: C1= 114 ps
- 2389 s: C1= 153 ps
- 1195 s: C1= 201 ps
- 597 s: C1= 289 ps
- 299 s: C1= 425 ps
- 149 s: C1= 599 ps
- 75 s: C1= 837 ps
- 37 s: C1= 1193 ps



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- 156138 s: P1= 43 ps
- 78069 s: P1= 43 ps
- 39034 s: P1= 121 ps
- 19517 s: P1= 77 ps
- 9759 s: P1= 68 ps
- 4879 s: P1= 99 ps
- 2440 s: P1= 131 ps
- 1220 s: P1= 168 ps
- 610 s: P1= 224 ps
- 305 s: P1= 320 ps
- 152 s: P1= 473 ps
- 76 s: P1= 676 ps
- 38 s: P1= 954 ps
- 156547 s: P2= 39 ps
- 78274 s: P2= 26 ps
- 39137 s: P2= 29 ps
- 19568 s: P2= 45 ps
- 9784 s: P2= 81 ps
- 4892 s: P2= 120 ps
- 2446 s: P2= 146 ps
- 1223 s: P2= 194 ps
- 612 s: P2= 268 ps
- 306 s: P2= 356 ps
- 153 s: P2= 542 ps
- 76 s: P2= 756 ps
- 38 s: P2= 1056 ps



BP1C-PTBG

## COMPUTATION OF BASELINE

Number of codes to fit baseline and biases = 155588  
 Computed code bias (P1/P2)/m = -150.574 -155.663  
 Computed baseline (X,Y,Z)/m = 6.461 -5.530 -4.542  
 RMS of residuals /m = 0.580

Number of phase differences to fit baseline = 154791  
 A priori baseline (X,Y,Z)/m = 6.461 -5.530 -4.542  
 19779 clock jitters computed out of 19779 intervals  
 AVE jitter /ps = 0.0 RMS jitter /ps = 4.4

Iter 1 Large residuals L1= 0  
 Iter 1 Large residuals L2= 1  
 Computed baseline L1 (X,Y,Z)/m = 0.053 0.052 0.054  
 RMS of residuals L1 /m = 0.004  
 Computed baseline L2 (X,Y,Z)/m = 0.053 0.048 0.055  
 RMS of residuals L2 /m = 0.004

Iter 2 Large residuals L1= 0  
 Iter 2 Large residuals L2= 1  
 Computed baseline L1 (X,Y,Z)/m = 0.053 0.052 0.054  
 RMS of residuals L1 /m = 0.004  
 Computed baseline L2 (X,Y,Z)/m = 0.053 0.048 0.055  
 RMS of residuals L2 /m = 0.004

Final baseline L1 (X,Y,Z)/m = 6.513 -5.478 -4.488  
 Final baseline L2 (X,Y,Z)/m = 6.514 -5.482 -4.488

## COMPUTATION OF CODE DIFFERENCES

Number of code differences = 160192

Global average of individual differences

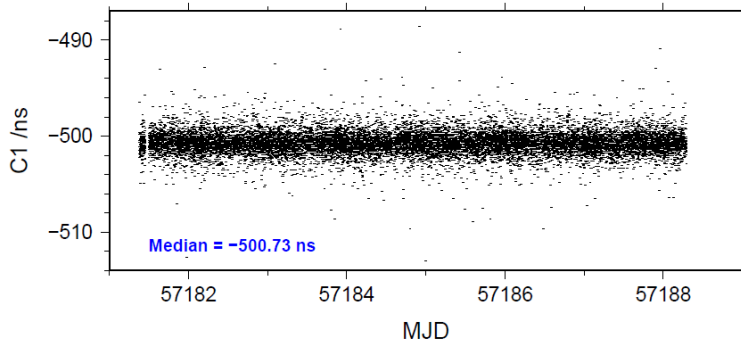
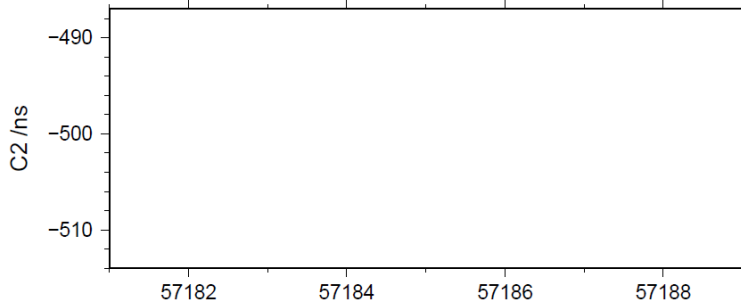
Code #pts, ave/ns, rms/ns  
 C1: 159038 -500.694 2.948  
 C2: 0-NaN -NaN  
 P1: 156041 -502.442 2.259  
 P2: 155655 -519.419 2.368

Number of 300s epochs in out file = 1981

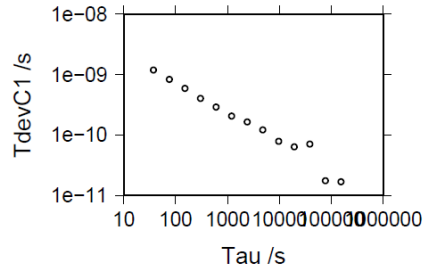
Code #pts, median/ns, ave/ns, rms/ns  
 C1: 15877 -500.728 -500.719 1.182  
 C2: 0 0.000-NaN -NaN  
 P1: 15581 -502.490 -502.466 0.951  
 P2: 15544 -519.432 -519.429 1.116



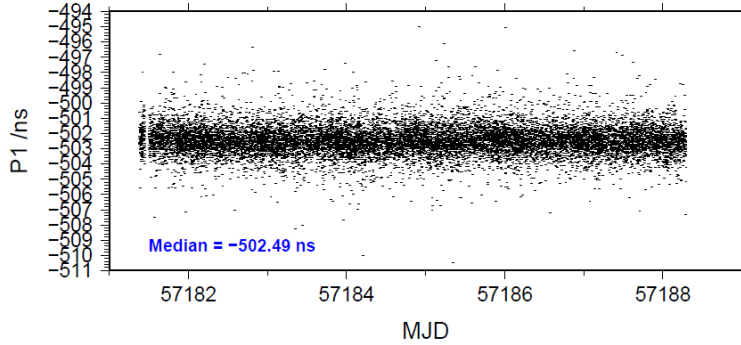
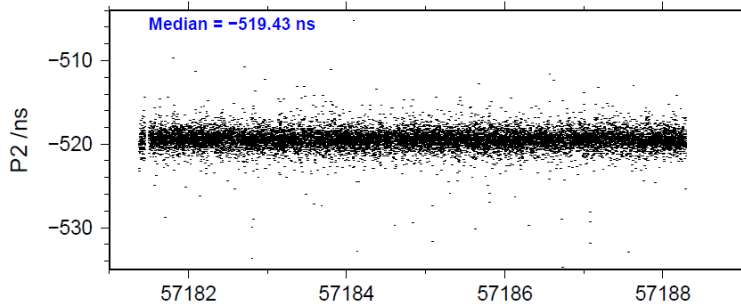
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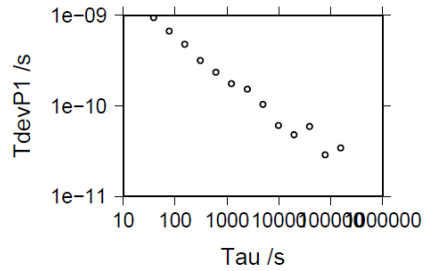
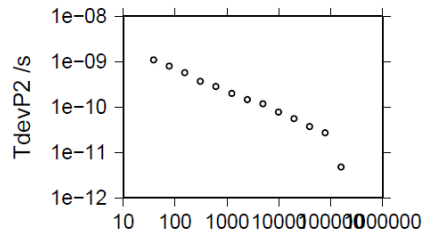
- 154180 s: C1= 17 ps
- 77090 s: C1= 18 ps
- 38545 s: C1= 71 ps
- 19273 s: C1= 64 ps
- 9636 s: C1= 78 ps
- 4818 s: C1= 121 ps
- 2409 s: C1= 165 ps
- 1205 s: C1= 205 ps
- 602 s: C1= 292 ps
- 301 s: C1= 403 ps
- 151 s: C1= 590 ps
- 75 s: C1= 836 ps
- 38 s: C1= 1183 ps



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- 157110 s: P1= 35 ps
- 78565 s: P1= 29 ps
- 39277 s: P1= 59 ps
- 19639 s: P1= 48 ps
- 9819 s: P1= 61 ps
- 4910 s: P1= 104 ps
- 2455 s: P1= 153 ps
- 1227 s: P1= 176 ps
- 614 s: P1= 236 ps
- 307 s: P1= 318 ps
- 153 s: P1= 479 ps
- 77 s: P1= 670 ps
- 38 s: P1= 944 ps
- 157484 s: P2= 5 ps
- 78742 s: P2= 27 ps
- 39371 s: P2= 37 ps
- 19685 s: P2= 56 ps
- 9843 s: P2= 78 ps
- 4921 s: P2= 119 ps
- 2461 s: P2= 145 ps
- 1230 s: P2= 199 ps
- 615 s: P2= 283 ps
- 308 s: P2= 371 ps
- 154 s: P2= 572 ps
- 77 s: P2= 794 ps
- 38 s: P2= 1105 ps



**4.8/ BIPM (15176)**Period

MJD 57198 to 57205

Delays

All measurements at BIPM carried out by L. Tisserand.

Equipment used to measure internal delay is a time interval counter (TIC), model SR620, maker Stanford Research Systems, s/n: 4680, with measurement uncertainty typically less than 0.5 ns (using external reference frequency as timebase).

## BP0R:

$$\begin{aligned} X_O &= 230.96 \text{ ns} && (270.98-48.72+8.7) \\ X_P &= 42.7 \text{ ns} && (BP1R+C139+BP1S+C72) \\ \text{REFDLY} &= 273.66 \text{ ns} \\ \text{CABDLY} = X_C &= 133.4 \text{ ns} && (C113) \end{aligned}$$

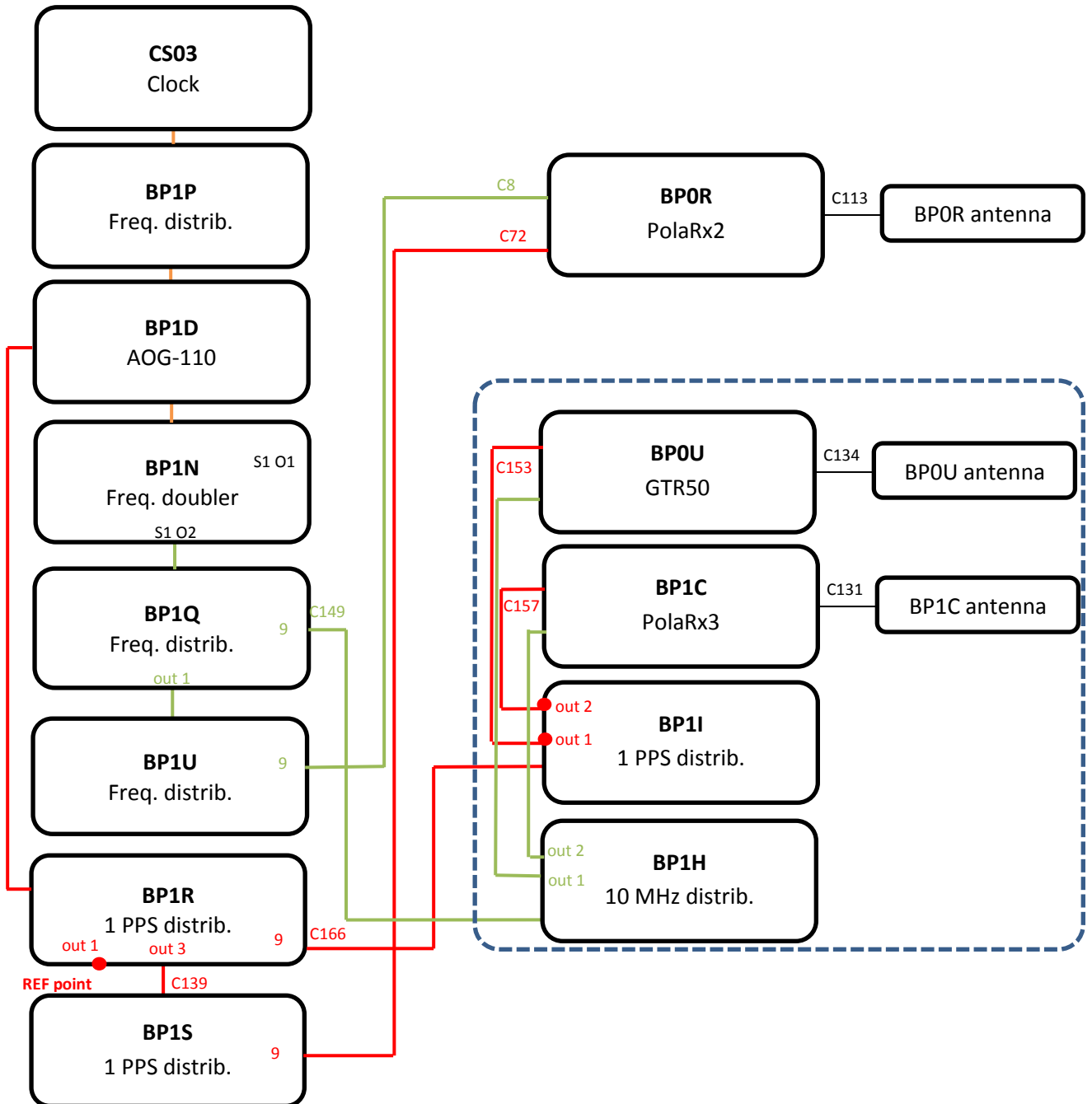
## BP0U:

$$\begin{aligned} \text{REFDLY} = X_P &= 52.6 \text{ ns} && (BP1R+C166+BP1I+C153) \\ \text{CABDLY} = X_C &= 182.0 \text{ ns} && (C134) \end{aligned}$$

## BP1C:

$$\begin{aligned} X_O &= 208.51 \text{ ns} && (267.32-58.81) \\ X_P &= 52.6 \text{ ns} && (BP1R+C166+BP1I+C157) \\ \text{REFDLY} &= 261.11 \text{ ns} \\ \text{CABDLY} = X_C &= 235.7 \text{ ns} && (C131) \end{aligned}$$

Setup at the BIPM



BP0U-BP0R

## COMPUTATION OF BASELINE

Number of codes to fit baseline and biases = 103633  
 Computed code bias (P1/P2)/m = -26.699 -25.658  
 Computed baseline (X,Y,Z)/m = -5.287 -0.804 4.269  
 RMS of residuals /m = 0.674

Number of phase differences to fit baseline = 93922  
 A priori baseline (X,Y,Z)/m = -5.287 -0.804 4.269  
 21691 clock jitters computed out of 22022 intervals  
 AVE jitter /ps = -0.2 RMS jitter /ps = 35.5

Iter 1 Large residuals L1= 0  
 Iter 1 Large residuals L2= 0  
 Computed baseline L1 (X,Y,Z)/m = 0.127 0.042 0.222  
 RMS of residuals L1 /m = 0.004  
 Computed baseline L2 (X,Y,Z)/m = 0.123 0.031 0.215  
 RMS of residuals L2 /m = 0.004

Final baseline L1 (X,Y,Z)/m = -5.160 -0.762 4.491  
 Final baseline L2 (X,Y,Z)/m = -5.164 -0.773 4.484

## COMPUTATION OF CODE DIFFERENCES

Number of code differences = 104094

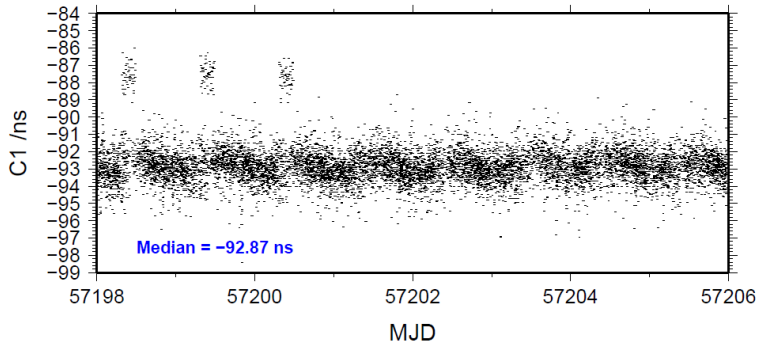
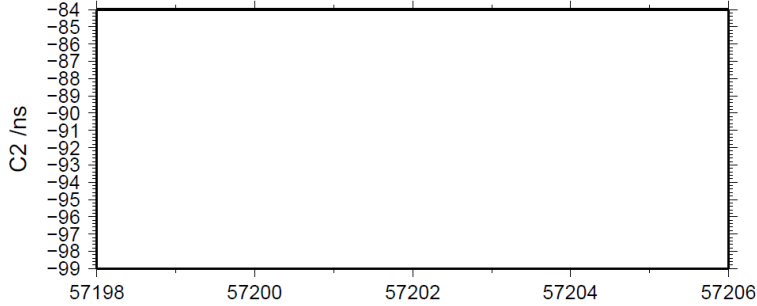
Global average of individual differences

Code #pts, ave/ns, rms/ns  
 C1: 104054 -92.815 1.640  
 C2: 0-NaN -NaN  
 P1: 103599 -89.701 2.373  
 P2: 103592 -86.201 2.588

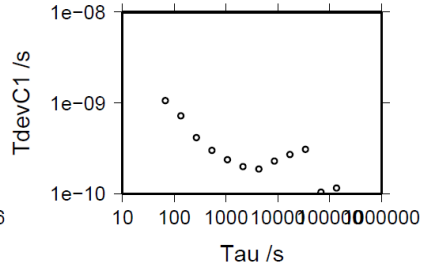
Number of 300s epochs in out file = 2304

Code #pts, median/ns, ave/ns, rms/ns  
 C1: 10357 -92.872 -92.812 1.074  
 C2: 0 0.000-NaN -NaN  
 P1: 10321 -89.760 -89.732 1.229  
 P2: 10322 -86.187 -86.176 1.430

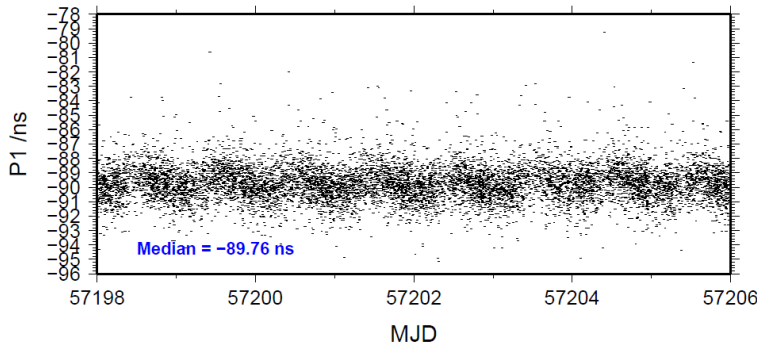
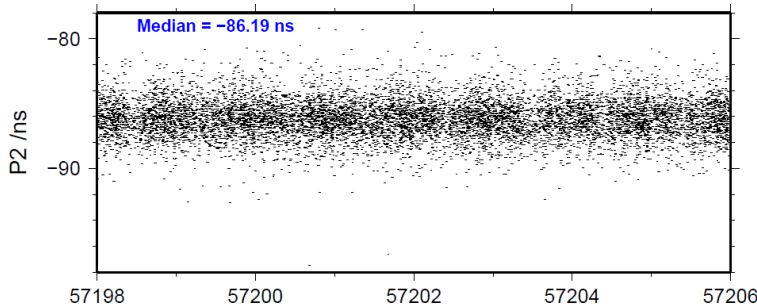
07/08/15 bp0ubp0r15176\_8



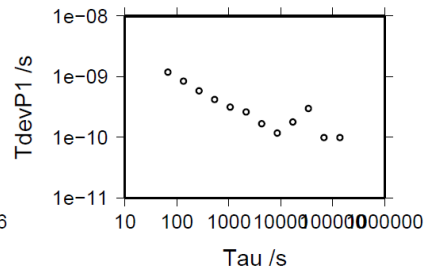
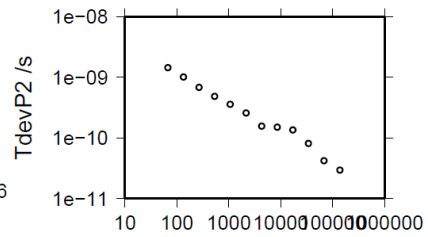
- 136632 s: C1= 115 ps
- 68316 s: C1= 103 ps
- 34158 s: C1= 307 ps
- 17079 s: C1= 271 ps
- 8540 s: C1= 229 ps
- 4270 s: C1= 186 ps
- 2135 s: C1= 199 ps
- 1067 s: C1= 237 ps
- 534 s: C1= 299 ps
- 267 s: C1= 413 ps
- 133 s: C1= 717 ps
- 67 s: C1= 1059 ps



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- 137109 s: P1= 99 ps
- 68554 s: P1= 99 ps
- 34277 s: P1= 300 ps
- 17139 s: P1= 178 ps
- 8569 s: P1= 117 ps
- 4285 s: P1= 167 ps
- 2142 s: P1= 261 ps
- 1071 s: P1= 315 ps
- 536 s: P1= 419 ps
- 268 s: P1= 580 ps
- 134 s: P1= 847 ps
- 67 s: P1= 1185 ps
- 137096 s: P2= 30 ps
- 68548 s: P2= 42 ps
- 34274 s: P2= 81 ps
- 17137 s: P2= 135 ps
- 8568 s: P2= 150 ps
- 4284 s: P2= 157 ps
- 2142 s: P2= 258 ps
- 1071 s: P2= 358 ps
- 536 s: P2= 486 ps
- 268 s: P2= 684 ps
- 134 s: P2= 1018 ps
- 67 s: P2= 1443 ps



BP1C-BP0R

## COMPUTATION OF BASELINE

Number of codes to fit baseline and biases = 147459  
 Computed code bias (P1/P2)/m = -17.584 -16.642  
 Computed baseline (X,Y,Z)/m = -4.506 -0.778 3.747  
 RMS of residuals /m = 0.675

Number of phase differences to fit baseline = 143911  
 A priori baseline (X,Y,Z)/m = -4.506 -0.778 3.747  
 22992 clock jitters computed out of 22993 intervals  
 AVE jitter /ps = 0.3 RMS jitter /ps = 5.5

Iter 1 Large residuals L1= 1  
 Iter 1 Large residuals L2= 4  
 Computed baseline L1 (X,Y,Z)/m = 0.028 0.068 0.062  
 RMS of residuals L1 /m = 0.005  
 Computed baseline L2 (X,Y,Z)/m = 0.035 0.074 0.067  
 RMS of residuals L2 /m = 0.005

Iter 2 Large residuals L1= 1  
 Iter 2 Large residuals L2= 4  
 Computed baseline L1 (X,Y,Z)/m = 0.028 0.068 0.062  
 RMS of residuals L1 /m = 0.005  
 Computed baseline L2 (X,Y,Z)/m = 0.035 0.074 0.067  
 RMS of residuals L2 /m = 0.005

Final baseline L1 (X,Y,Z)/m = -4.478 -0.710 3.809  
 Final baseline L2 (X,Y,Z)/m = -4.471 -0.705 3.814

## COMPUTATION OF CODE DIFFERENCES

Number of code differences = 152383

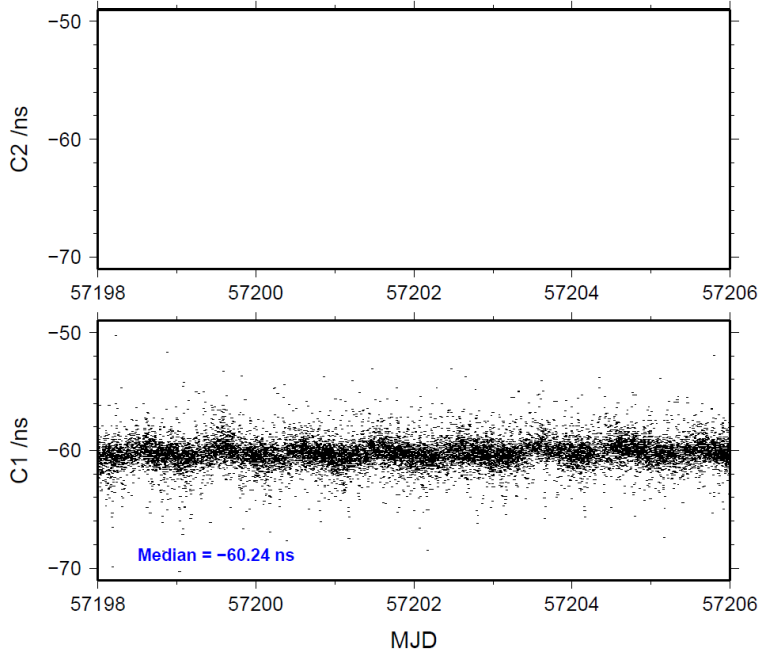
Global average of individual differences

Code #pts, ave/ns, rms/ns  
 C1: 151525 -60.222 2.097  
 C2: 0-NaN -NaN  
 P1: 147407 -58.842 2.559  
 P2: 147271 -55.731 2.887

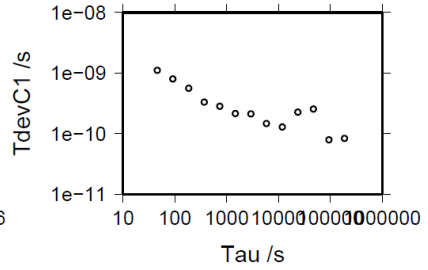
Number of 300s epochs in out file = 2304

Code #pts, median/ns, ave/ns, rms/ns  
 C1: 15042 -60.238 -60.230 1.159  
 C2: 0 0.000-NaN -NaN  
 P1: 14669 -58.936 -58.869 1.395  
 P2: 14653 -55.732 -55.735 1.702

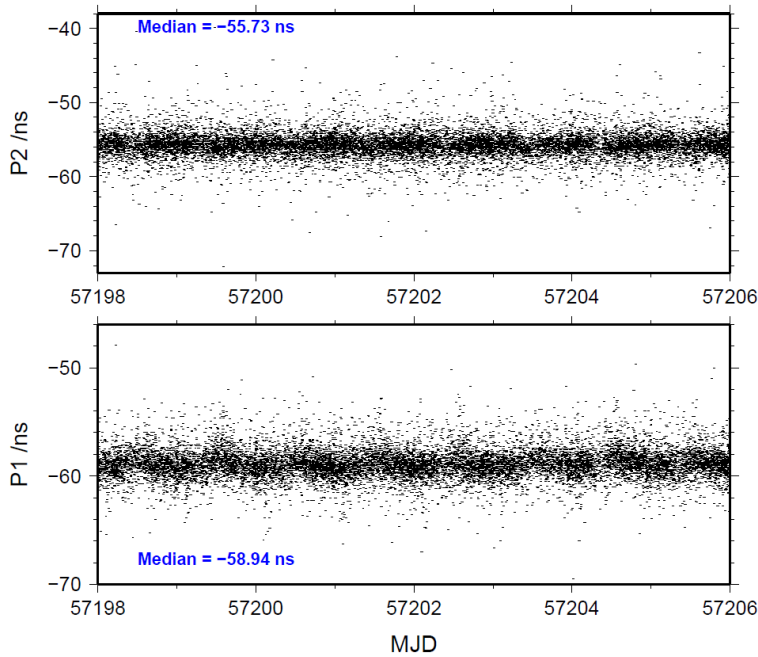
07/08/15 bp1cbp0r15176\_8



- 188147 s: C1= 83 ps
- 94074 s: C1= 79 ps
- 47037 s: C1= 253 ps
- 23518 s: C1= 226 ps
- 11759 s: C1= 129 ps
- 5880 s: C1= 146 ps
- 2940 s: C1= 211 ps
- 1470 s: C1= 215 ps
- 735 s: C1= 283 ps
- 367 s: C1= 333 ps
- 184 s: C1= 561 ps
- 92 s: C1= 798 ps
- 46 s: C1= 1116 ps



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- 192932 s: P1= 94 ps
- 96466 s: P1= 67 ps
- 48233 s: P1= 217 ps
- 24116 s: P1= 215 ps
- 12058 s: P1= 146 ps
- 6029 s: P1= 157 ps
- 3015 s: P1= 227 ps
- 1507 s: P1= 273 ps
- 754 s: P1= 357 ps
- 377 s: P1= 437 ps
- 188 s: P1= 681 ps
- 94 s: P1= 974 ps
- 47 s: P1= 1362 ps
- 193143 s: P2= 31 ps
- 96571 s: P2= 29 ps
- 48286 s: P2= 93 ps
- 24143 s: P2= 128 ps
- 12071 s: P2= 134 ps
- 6036 s: P2= 144 ps
- 3018 s: P2= 198 ps
- 1509 s: P2= 292 ps
- 754 s: P2= 427 ps
- 377 s: P2= 588 ps
- 189 s: P2= 852 ps
- 94 s: P2= 1212 ps
- 47 s: P2= 1698 ps

